U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

TRC

TRC Environmental Consultants, Inc.
5 Waterside Crossing, Windsor, CT 06095
(203) 289-8631
Fax: (203) 298-6399
A TRC Company

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1.0 INTRODUCTION

This report presents the current situation at each of the four remedial investigation and feasibility study sites at the Naval Education and Training Center (NETC) in Newport, Rhode Island Figure 1). The Remedial Investigation and Feasibility Study (RI/FS) is being conducted under contract N62472-86-C-1282 for the NORTHNAVFACENGCOM. TRC Environmental Corporation (TRC) was authorized to begin work on the Phase II RI/FS Work Plan on August 6, 1992. The Phase II RI/FS Work Plan addresses the following site:

Site 02 - Melville North Landfill

The following sites are addressed in a separate investigation:

Site 01 - McAllister Point Landfill
Site 09 - Old Fire Fighting Training Area
Site 12 - Tank Farm Four
Site 13 - Tank Farm Five

Previous investigations at NETC Newport included: an Initial Assessment Study (IAS) in 1983; a Confirmation Study (CS) in 1986; a Closure Plan for Tanks 53 and 56 at Tank Farm Five in 1988; and a Phase I RI/FS investigation completed in 1991. The Initial Assessment Study (IAS), conducted by Envirodyne Engineers, Inc., St. Louis, Missouri, for the Navy in 1983, identified sites where contamination is suspected to exist and which may pose a threat to human health or the environment. A total of eighteen potential sites were identified by the IAS (Table 1). Six of these sites which were judged to require further study and were investigated under a Confirmation Study (CS), conducted by Loureiro Engineering Associates, Avon, Connecticut, completed in 1986. The Phase I RI/FS investigation was conducted on four sites. Three of the sites, McAllister Point Landfill, and Tank Farm 4, were investigated in both the IAS and CS. Tank Farm 5 was studied in the IAS, and tank numbers 53 and 56 were extensively studied as part of a tank closure plan. The Old Fire Fighting Area has not been sampled or extensively studied in any way. The numbers for the four RI/FS sites were assigned during the IAS and were retained during the Phase I RI/FS investigation for consistency and to avoid confusion.

In April 1973, the Shore Establishment Realignment Program (SER) resulted in drastic reductions in Navy personnel at the Newport base and initiated the process of excessing (selling) large portions of the base's real estate. The only RI/FS site that is not in the process of being excessed is the Old Fire Fighting Training Area. The final sale of the remaining four excessed areas by the General Services Administration (GSA) is pending the results of the IR Program. The status of all eighteen potentially contaminated sites is presented in Table 2.

The entire NETC was listed on the U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) of abandoned or uncontrolled hazardous waste sites in November 1989. The NPL identifies those sites which pose a significant threat to the public health and environment. The four RI/FS sites at the NETC (McAllister Point Landfill, Old Fire Fighting Training Area, and Tank Farm Four and Five) are currently being studied (Phase I was completed in 1991) by the Navy under the Department of Defense Installation Restoration (IR) Program. This program is similar to the U.S. EPA's Superfund Program authorized under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

A Federal Facilities Interagency Agreement (FFA) was signed by the Navy, the State of Rhode Island, and the EPA on March 23, 1992. The FFA outlines response action requirements under the Department of Defense Installation Restoration Program at the NETC. The FFA was developed, in part, to ensure that environmental impacts associated with past and present activities at NETC are thoroughly investigated and remediated, as necessary. The four RI/FS sites and the additional six study areas were listed in the FFA (Figure 2).

The fifth Phase I RI/FS site not listed in the FFA is Site 02, the Melville North Landfill. The non-NPL status of this site and its resulting exclusion from the FFA, is due to the site not being owned by the Navy at the time of the NPL listing of the NETC. However, the Melville North Landfill site is being addressed under a Phase II RI/FS. The scope of the Melville North Landfill RI/FS is presented in this work plan. Six additional sites (Tank Farm One, Tank Farm Two, Tank Farm Three, Coddington Cove Rubble Fill Area, NUSC Disposal Area, and the Gould Island Electroplating Shop) or study areas (as referred to in the FFA) are also currently planned for initial investigations under Study Area Screening Evaluations (SASEs).

This report is organized into two main sections, NETC Background, and History of Response Actions. The first four subsections of the Site Background section address the regional physiography, geology, and hydrology of the NETC, as well as its general history. The second section, History of Response Actions, presents a chronology of environmental regulatory actions which have impacted the NETC and the Navy's response to those actions.

2.0 SITE BACKGROUND

This section presents a review of the history, geology, and hydrology of NETC Newport and the individual sites being addressed in this investigation. Extensive information in these areas has already been gathered in the IAS (Envirodyne Engineers, 1983), CS (Loureiro Engineering Associates, 1985), and Phase I RI/FS (TRC, 1991). Therefore, blocks of text will be incorporated from these reports and referenced with a "IAS" or "CS" and the appropriate reference page numbers.

2.1 History of the NETC

The NETC is located north of Newport, Rhode Island, (Figure 1) on the west shore of Aquidneck Island facing the east passage of Narragansett Bay. The history of the base is as follows:

> The Newport area was first used by the Navy during the Civil War when the Naval Academy was moved from Annapolis, Maryland to Newport in order to protect it from Confederate troops. The Naval Academy operated at Newport for about four years before returning to Annapolis.
>
> In 1869, the experimental Torpedo Station at Goat Island was established. This was the Navy's first permanent activity at Newport. The station was responsible for developing torpedoes and conducting experimental work on other forms of naval ordinance.
>
> In 1881, Coasters Harbor Island was acquired by the Navy from the City of Newport and used for training purposes. In 1984, the Naval War College was established on the island. A causeway and bridge linking the island to the mainland was constructed in 1892. In 1984, the USS Constellation was permanently anchored as a training ship for the Naval War College.
>
> The Melville area was established as a coaling station for the steam-powered ships in 1900. The Navy purchased 160 acres of land and constructed the Narragansett Bay Coal Depot. With the advent of ships burning liquid fuel, it became necessary to add oil tanks. Consequently, in 1910, four fuel oil tanks were added in the Melville area. These tanks are still used today.
>
> In 1913, the Navy established the Naval Hospital on the mainland of Aquidneck Island, directly adjacent to Coasters Harbor Island. At this time, the main hospital building was constructed.

The outbreak of World War I caused a significant increase in military activity at Newport. Some 1,700 men were sent to Newport and housed in tents on Coddington Point and Coasters Harbor Island. A bridge was built at this time connecting Coddington Point with Coasters Harbor Island. In 1918, Coddington Point was purchased by the Navy. Much of the base organization was then transferred to Coddington Point. During the war, numerous destroyers and cruisers were fueled by the Melville coal depot and fuel tanks. By this time, a pipeline had been extended to the north fueling pier and two additional oil tanks constructed.

Following World War I, fuel oil gradually replaced the use of coal by the Navy fleet. In 1921, the Coal Depot was changed to the Navy Fuel Depot. In 1931, the coal barges and coaling equipment were sold to the highest bidder.

In 1923, some two hundred buildings, which were part of the emergency war camps established on Coddington Point, were stripped and sold for scrap. The station was put on caretaker status in 1933. The base remained relatively inactive until the onset of World War II.

Reactivation of the base occurred in the late 1930s as a result of military build-up in Europe. Just prior to the reactivation, a 1938 hurricane and tidal wave had destroyed or severely damaged over 100 buildings and much of the sea walls. In 1940, Coddington Cove was acquired for use as a supply station, and hundreds of Quonset huts were constructed throughout the base. Additional barracks were constructed on Coasters Harbor Island, increasing the base housing capacity to over 3,500 men. Power plant facilities were also constructed at this time. Coddington Point was reactivated to house thousands of recruits. The Anchorage housing complex in the Coddington Cove area was constructed in 1942. In the Melville area, additional fuel facilities were constructed along with a Motor Torpedo Squadron Boat Training Center and nets for harbor defense were constructed. Tank Farms 1 through 5 were constructed during this time period. The Fire Fighting School, Fire Control Training Building, and the Steam Engineering Building were constructed in 1944.

The Torpedo Station at Goat Island was very active during World War II and had expanded its operation to Gould Island. The Torpedo Station employed more than 13,000 people and manufactured 80 percent of all torpedoes used by our country during the war. The station was the largest single industry ever operated in Rhode Island.

Following World War II, naval activities at Newport converted to a peace time status. This resulted in a reduction of naval activity. Some 300 Quonset huts and buildings were removed, and the entire naval complex was consolidated into a single naval command designated the U.S. Naval Base in 1946.

The Naval Base adjusted to its peace time status by increasing its activities in the fields of research and development, specialized training, and preparedness for modern warfare. There was a brief period during the Korean War when some 25,000 sailors trained at Newport.

In 1951, the Torpedo Station was permanently disestablished after 83 years of service. Future manufacture of torpedoes was to be awarded to private industry. In place of the Torpedo Station, a new research and development facility, the Naval Underwater Ordinance Station, was established and given the responsibility of overseeing the private contractors. The Officer Candidate School was also established in 1951.

In 1952, the Training Station and other naval schools were disestablished, and the U.S. Naval Station and the U.S. Naval Schools Command were established.

In 1955, Pier 1 was constructed, with Pier 2 being added in 1957. Newport became the headquarters of the Commander Cruiser-Destroyer Force Atlantic in 1962. Some 55 naval warships and auxiliary craft were homeported at Newport. New housing and bachelor quarters were added in the late 50's and early 60's.

Major expansion of the Naval War College occurred during the late 50's and early 70's, transforming the college into a major university. In July of 1971, the Naval Schools Command was restructured and named the Naval Officer Training Center (NOTC).

In April of 1973, the Shore Establishment Realignment Program (SER) was announced and resulted in the largest reorganization of Naval forces in the Newport area. The fleet stationed in Newport was relocated to other naval stations on the east coast. SER resulted in the disestablishment of the Naval Communication Station and the Fleet Training Center and related activities. The Public Works Center, Naval Supply Center, Naval Station and Naval Base were absorbed by NOTC. In April of 1974, NOTC was changed to the Naval Education and Training Center (NETC).

The drastic changes which resulted from SER caused a reduction of Navy personnel, both military and civilian, in excess of 14,000. Coupled with the reductions at the Naval Construction Battalion Center at Davisville, and the closure of the Naval Air Station at Quonset Point, SER had severe economic impacts in the Narragansett Bay area.

The reorganization brought about by SER resulted in the Navy excessing some 1,629 acres of its 2,420 acres. Some of the land has been leased to the State of Rhode Island pending final sale of the land by the General Services Administration. Table 1 [in IAS] shows an area by area breakdown on land holdings prior to SER and following. The Navy also leases 44 acres of land in Coddington Cove to the State of Rhode Island and Economic Development Corporation. The state has subleased this property to a private enterprise engaging in shipbuilding and repair. Also, a fish food processing operation utilizes the cold storage warehouse in Building 42 near Pier 1.

The above information on the history of the installation was obtained from the most recent Master Plan (NORTHDIV, 1980), the 1981 Annual Report of the Navy in the Rhode Island Area (NETC Public Affairs Office, 1981), and the Command Histories at the Naval History Office in Washington, DC.

(IAS, pp. 5-6 to 5-14)

2.2 Regional Physiography

This section is divided into three subsections: climate, terrestrial features, and marine features. Regional geology and hydrology will be addressed in separate sections following this discussion. Additional site-specific studies regarding site terrestrial and marine features will be performed under the Phase II Ecological Risk Assessment.

2.2.1 Climate

The climate at NETC Newport is presented below. Much of the climatalogical information was obtained from the IAS report, and is referenced as such with page numbers which follow excerpts.

> The climate at NETC is greatly influenced by its proximity to Narragansett Bay and Atlantic Ocean, which tend to modify the area's temperatures. Winter temperatures are somewhat higher and summer temperatures lower than more inland areas. Winters are moderately cold in the area, and summers are generally mild with many summer days cooled by sea breezes. . . .
>
> The average annual precipitation for the area is 42.75 inches, but this has varied from as little as 25.44 inches to as much as 65.06 inches. Measurable precipitation (.01 inch or greater) occurs on about one day out of every three and is evenly distributed throughout the year. Thunderstorms are responsible for much of the rainfall from May through August. These thunderstorms often produce heavy amounts of rainfall, but their duration is relatively short. Summer thunderstorms are frequently accompanied by high winds which may result in property damage, especially to small boats. The average snowfall during winter is close to 40 inches, ranging from a low of 11.3 inches to a high of 75.6 inches. February is usually the month of greatest snowfall, but January and March are close seconds. It is unusual for the ground to remain snow covered for any long period of time. . . .

Severe weather from tropical cyclones (winds 39 to 73 miles per hour) and hurricanes (winds greater than 73 miles per hour) is a serious threat in the area of NETC. The probability that a tropical cyclone will invade the area is one in five in any year, while the probability of hurricane force winds invading the area is less than one in fifteen in any year (Outleasing EIS, 1977). The most damage from these severe storms results when they strike at high tide.

(IAS, pp. 5-14 to 5-15)

2.2.2 Terrestrial Features

The topography of the NETC area was shaped by the bedrock geology, glaciation, and recent erosion. The bedrock geology controlled the locations of the ancient river valleys which glaciers subsequently gouged out of the bedrock. The hills are the result of bedrock highs. A mantle of till, on average 20 feet thick, was spread over the bedrock during the Wisconsin glaciation. As the glaciers melted, ocean levels rose and flooded the river valleys forming the passages of Narragansett Bay.

Elevations at NETC range from near mean sea level to 175 feet in the Melville North area. Many areas of NETC have low elevations which are susceptible to flooding during hurricane storm surges. The 100 and 500 year tidal flood elevations for the NETC area are 12.6 feet and 15.6 feet above mean low water, respectively. Areas below these elevations are subject to flooding.

Ninety percent of the land within the boundaries of NETC has slopes of from 0 to 9 percent (Master Plan, 1980). The remaining land has slopes in the categories of 10 to 25 percent and greater than 25 percent. Maps showing slopes on all NETC areas are included in the most recent Master Plan for NETC.

(IAS, pg. 5-15)

The soils in the area of NETC formed in glacial deposits of till and outwash. . . . There are also a few areas with tidal marsh soils along the shores of Narragansett Bay. These tidal marsh areas receive deposits of silt and clay during tidal inundation and from upland areas. These sediments are deposited along with the plant remains of the salt tolerant plants growing in the marshes.

(IAS, pg. 5-21)

There are five basic types of soils at the NETC: mucks, beaches, loams, sands, and urban complexes. The mucks are found in tidal flats and inland depressions which hold ponded water. Loams (mixture of sand, silt, clay, and organic matter) and sands are found in upland areas on-site and generally drain rapidly. Urban complexes are mixtures of natural soils, imported soils, and urban materials.

The flora and fauna of the NETC is strongly influenced by human activity.

> The southern portion of the base is heavily industrial with machine shops and other support facility operations. The north portion of the base is divided in land usage between residential, vacant (held for expansion), tank farms, and storage-fueling facilities (industrial). There are no land areas on NETC which have not been disturbed at some time during base operations. . . .
>
> Southern Rhode Island has relatively few forests of mature climax successional stage. Fires, logging, and the agricultural conversion of forest land prior to the Civil War have greatly reduced the extent of climax forest acreage. The predominant forest vegetation in southern Rhode Island is that of abandoned fields in early successional stages, and forests of immature hardwoods. Pure stands of mature softwoods are the least abundant. . . .
>
> The upland vegetation within the NETC is restricted primarily to perennial weeds and grasses. The majority of trees is located near residences, drainageways and around the tank farms. The upland vegetation of NETC reflects complete management (mowing) or recent disturbance of the area.
>
> The habitats available for lowland vegetation on the NETC are located on the waterfront along Narragansett Bay and surrounding the small impoundments and their drainages further inland. Those areas located on the waterfront are comprised of borrow pits along the railroad tracks and abandoned disposal areas where excavation has created depressions.
>
> The largest of these depressions is the Melville North landfill. This area was excavated during landfill operations and depressions were created. These depressions support a limited diversity of wetland flora including reeds and various shrub and grass species. Borrow pits can be found along the railroad tracks which parallel the shoreline extending from McAllister Point northward to the Melville North landfill. These are individually less than one acre in size and contain similar wetland species with a lack of diversity.
>
> All lowlands on NETC have been artificially created and are in a disturbed condition. The potential for maintaining diversified floral species within the lowlands of NETC is

poor. This area did not previously contain these habitats, and sills and drainage are not conducive to their successional development.

The fauna of the region have been affected by similar disturbances (clearing, excavation, construction) which led to the impoverishment of the flora. Field studies have indicated impoverished fauna, particularly of herptile and mammal types. Widespread habitat destruction over a period of several hundred years has caused emigration or elimination of many species. As a result, the present regional fauna consist primarily of species of wide distribution and ecological tolerances, high adaptability, and nonrestrictive habitat requirements.

No large animals such as deer, turkey, or cougar are known within the boundaries of NETC. However, red fox, raccoon, rabbit, and gray squirrel are present in the woodlands.

Mammalian forms expected to be found on base include: the Eastern chipmunk, New England cottontail rabbit, white-footed mouse, short tailed shrew, gray squirrel, and red squirrel. Several of these species inhabit the few remaining wooded areas on base slated to be excessed.

Various herptiles occupy NETC habitats. Common ones include the red backed salamander, American toad, wood frog, eastern gartersnake, northern black racer and the wood turtle.

Common herptiles of the wet areas include the American toad, spring peeper, bullfrog and northern watersnake (Natrix sipedon), along with the snapping turtle.

Avian species which may be found within the NETC upland habitats include the bobolink, meadowlark, chimney swift, kingbird, eastern phoebe (Sayorius phoebe), barn shallow, red-tailed hawk and kestrel.

In addition, game birds, such as the ring-necked pheasant, bobwhite quail and the mourning dove, are highly dependent on the plant communities on the base.

(IAS, pp. 5-37 to 5-39)

2.2.3 Marine Features

The Narragansett Bay marine features are presented below. Much of the marine features information was obtained from the IAS report, and is referenced as such with page numbers which follow excerpts.

Narragansett Bay occupies three former river valleys which have been drowned by the advance of the Atlantic Ocean. Narragansett Bay is 20 miles long and 11 miles wide. The bay has a surface area of 102 square miles. Figure 5.3-7 shows Narragansett Bay and the surrounding areas. The shape of the former river valleys has changed little since the last glaciation. The bay is divided into an eastern and western passage by Conanicut Island. The average depth of the bay is 30 feet. In the western passage, the average depth is 25 feet, while in the eastern passage, the average depth is 50 feet. The eastern passage, which NETC fronts, allows deep water access up to the south end of Prudence Island. Channel depth exceeds 80 feet in the eastern passage from Gould Island seaward, and depths in excess of 150 feet occur near the mouth of the bay.

Freshwater flows into the bay at an average rate of 1,239 cubic feet per second from a drainage area of 1,850 square miles. This accounts for 90 percent of the annual flow of fresh water into the bay. The other 10 percent is provided by direct rainfall into the bay and sewage effluent. An average of some 43 inches per year of precipitation falls directly into the bay. The freshwater input into the bay is small compared to the large volume of saline water in the bay. The relatively small freshwater input into the bay results in the bay water being well mixed with only small salinity gradients through the bay. Salinities range from about 22 parts per thousand (ppt) in the Providence River to 32 ppt at the mouth of the bay.

Tides are semi-diurnal in Narragansett Bay with a mean range of 3.6 feet at the mouth of the bay and 4.6 feet at the head. Abut 13 percent of the volume of water in the bay is exchanged each tidal cycle (Oviatt and Nixion, 1973). This is over 250 times the mean tidal river flow into the bay during a tidal cycle. The tidal movement is the single most important factor in water circulation in the bay. Tidal currents range in velocity from 0.07 to 2.3 feet per second (Atlantic Scientific, 1982). The faster velocities occur in the east and west passages near the mouth of the bay, while slower velocities occur in the upper bay.

Non-tidal current in the bay moves slowly at an average of 0.34 feet per second (Olsen, 1980). Although the non-tidal currents are slow, they are important in the exchange of water out of the bay and into Rhode Island Sound. The amount of time needed to transport a particle of water from Providence to the mouth of the bay is some 45 to 50 days (Olsen, 1980). However, this time can vary depending on the winds. Research seems to indicate that southeast winds blowing up the bay may prevent surface waters from flowing down the bay (Olsen, 1980).

The sediments in the bay are contaminated with heavy metals, hydrocarbons, and sewage sludge (Master Plan, 1980). A survey conducted by EPA (EPA, 1975) has shown the presence of heavy metal concentrations in the sediments in interstitial waters north of the Naval Complex. The values found were 7,048 mg/l manganese, 2,351 mg/l zinc, 559 mg/l iron, 55 mg/l lead, 46 mg/l nickel, 44 mg/l copper, and less than 1 mg/l cadmium.

These contaminants are the result of industrial and municipal discharges into the bay. No sediment samples have been taken in the area of the Naval Complex.

The water quality for Narragansett Bay as determined by the State of Rhode Island is shown in Figure 5.3-8 (Figure 3). Most of the bay is Class SA, which means it suitable for direct shellfish harvesting, bathing and other water contact sports. Areas classified as SB are suitable for shellfish harvesting after depuration and for bathing and other recreational activities. Areas classified as SC are suitable for fish, shellfish, and wildlife habitat areas, but the shellfish cannot be harvested. The entire shoreline of NETC is closed to shellfishing.

(IAS, pg 5-28, 5-31)

The marine ecosystem of Narragansett Bay forms the shoreline of the base for approximately 9 miles. The bay is of great economic and aesthetic importance of the entire southern portion of Rhode Island. It is an estuary and the fishery resources of the bay are extremely important. The annual value of the combined commercial and sport fishing is estimated at several million dollars.

In Narragansett Bay, the phytoplankton are by far the most important primary producers, synthesizing organic matter from carbon dioxide and inorganic nutrients with sunlight as the energy source. In shallower, less turbid estuaries, seaweeds and sea grasses may assume this role. . . .

The phytoplankton and zooplankton are rich and varied in Narragansett Bay. The species composition is relatively uniform from station to station indicating a good movement of the water mass within the bay. The estimated productivity figure of 84 grams of carbon per square meter per year is also indicative of good environmental conditions. . . .

Most species of finfish move in and out of Narragansett Bay following well established seasonal patterns. These migratory movements, although different for each species, provide for distinct summer and winter populations of finfish. The migrations are related primarily to temperature, and the major shifts between winter and summer populations take place when the water temperature is about 10°C (50°F).

Narragansett Bay is visited each year by a great many species of fish because it lies along the boundary between southern and northern populations. Thus, herring from Georges Bank may visit the bay at the end of their southward midwinter migrations, and species such as scup and occasional exotic tropical strays brought up by the Gulf Stream make their appearance during the summer. In all, over 100 species may appear in any given year, about half of which are occasional visitors.

In various studies during the 1970's a total of 99 species of fish have been taken from Narragansett Bay (Oviatt and Nixon, 1973; Jeffries and Johnsons, 1974; Camp, Dresser and McKee, 1978; Department of the Navy, 1978). Ten species accounted for 91 percent of the fish catch with the winter flounder, the sand dab, scup and butterfish the most commonly occurring fish taken. These four species are also of commercial importance. . . .

A year-long, bay-wide survey (excluding Mount Hope Bay and the Sakonnet River) of bottom fish made in 1972 yielded an annual minimum estimate of 117 individuals, or 28.5 pounds per acre. This translates into a standing crop of 1.9 million pounds of bottom fish. (The margin of error gives a range of 0.8 to 2.9 million pounds.) This is comparable to other estimates made using similar sampling techniques in New England estuaries and offshore fishing grounds. This bay-wide survey showed that despite the constant movement of species in and out of the bay, the total biomass of bottom fish is remarkably steady.

There are fewer species of pelagic fish than of bottom fish in the bay, but they make up for this by their numbers and their importance to fishermen. All the pelagic species are highly seasonal, with anchovies and sea herring appearing in the winter, and menhaden, bluefish, and striped bass in the summer. When schools of menhaden are present, their biomass may be far greater than that of the bottom fish. Population estimates for the bay are for as much as 16 million pounds of menhaden and 2 million pounds of bluefish and stripers. . . .

The benthic community in Narragansett Bay plays a critical role in the functioning of the ecosystem. Benthic filter feeders consume significant amounts of phytoplankton, and the bay's high primary productivity may be attributable in good part to the recycling activity of the benthos. . . .

The shellfish of Narragansett Bay include both bivalve molluscs (clams, oysters, scallops) and decapod crustaceans (crabs, shrimp, lobster). Lobster are caught both within and outside of Narragansett Bay. Lobsters are trapped in much of Narragansett Bay including the Coddington Cove area. Some lobster traps are located a short distance from Pier 2.

Bivalves harvested in the region of Narragansett Bay include the northern quahog - known as they bay quahog in Rhode Island), soft shell clam, and Atlantic bay scallop.

The quahog is the most valuable shellfish resource within the bay system. The number of people harvesting this organism for individual or commercial use is increasing. Shellfishing areas open to the public do not include the NETC shoreline.

Quahogs are the most abundant benthic animal of their size in Narragansett Bay (URI, 1980, Bulletin #40). In recent years, the total Rhode Island harvest ranged from 5 million pounds of meats in 1955 to 2 million pounds in 1978, the great majority of which are taken from the bay. . . .

Water pollution continues to take a heavy toll in the reduced numbers of quahogs available for harvesting. The primary criterion used in closing areas to shellfishing is the abundance of fecal coliforms in the water; these are an indicator of sewage and the pathogenic bacteria and viruses it may contain. A shellfish depuration plant is capable of killing harmful microorganisms that might be found within the shellfish, but not has been built in the bay area. Unfortunately, pathogenic microorganisms are only one aspect of the pollution in the upper bay. There are signs that Providence River quahogs are not healthy and may be dying off at least in some areas. Several researchers are concerned that they may be accumulating significant levels of petroleum or heavy metals, which are not removed by the usual depuration methods.

Aquaculture within the bay includes the eastern oyster and the blue mussel. Two species of clams are harvested offshore and landed at bay fishing ports. They are the Atlantic surf clam and the ocean quahog. Most of the northern areas of the bay are closed permanently or opened on a conditional basis. Most of the lower bay localities are opened. The shellfish area just south of the Newport Naval Facility is permanently closed because of municipal sewage discharge.

A small commercial fishery for squid occurs in the bay. A large squid trap is presently located in Coddington Cove (RI DEM, 1982) Sportsmen harvest squid with rod and reel throughout the spring and early summer months in the lower bay.

The blue crab and the rock crab are taken throughout the bay by recreational fishermen. Both of these species inhabit the shallow bays, sounds, and pools during the warm months and migrate to deeper water in the fall. The commercial fishing for blue crabs ended in 1938 with a severe population decline. The reason for the decline is not understood, but pollution from heavy metals and chlorinated hydrocarbons may have played an important role. At present, the population of blue crabs is increasing. The commercial use for rock crabs will be expanded with the development of new techniques for extracting the crab meat from the shells.

The Blue Gold Sea Farm, Inc. has leased five acres north of NETC for rearing the blue mussel. They suspend string from floats to which the larval stages of the mussel attach. It takes about 18 months for these mussels to reach market size. Eastern oysters are being cultured on suspended strings in coastal ponds on Prudence Island and southwestern shores of the bay. Scallop seed is planted in the bay, and in 1978, the catch was valued at one million dollars (Rhode Island Statewide Planning Program, 1979).

(IAS, pp. 5-40 to 5-47)

2.3 Regional Geology

The regional geology for NETC Newport is presented below. Much of the regional information was obtained from the IAS report, and is referenced as such with page numbers which follow the excerpts.

> NETC is located at the southeastern end of the Narragansett Basin. This basin is a complex synclinal mass of Pennsylvanian aged sedimentary rocks and is the most prominent geologic feature in eastern Rhode Island and adjacent Massachusetts. Narragansett Basin is an ancient north to south trending structural basin originating near Hanover, Massachusetts. The basin has a length of approximately 55 miles and varies from 15 to 25 miles wide. The western margin of the basin is in the western portion of Providence, Rhode Island, and the eastern margin runs through Fall River, Massachusetts. Exposures of older rocks on Conanicut Island and in the vicinity of Newport suggest that the southern extent of the basin is near the mouth of Narragansett Bay.
>
> The rocks of the Narragansett Basin are non-marine sedimentary rocks of Pennsylvanian age. The rocks are chiefly conglomerates, sandstones, shales, and anthracite. Total thickness of the strata in the Narragansett Basin has been estimated at 12,000 feet. Both vertical and lateral irregularities in the lithologic character of the rock are present within the basin. Many folds and some faults occur throughout the basin, but the character and amount of the folding and faulting are not clearly known. The sedimentary rocks of the basin are believed to have been deposited in a lowland area which was surrounded by an upland area of considerable relief. The presence of coal beds within the basin also indicates that there were fairly extensive swampy areas. Figure 5.3-2 shows a general geologic map of Rhode Island.
>
> The bedrock of the Narragansett Basin has been divided into the following five units: the Rhode Island Formation, Dighton Conglomerate, Wansulta Formation, Pondville Conglomerate, and Felsite at Diamond Hill. AT NETC and most of the surrounding area, the bedrock is entirely of the Rhode Island Formation, and thus, only this unit will be examined in detail. Figure 5.3-3 represents a detailed look at the geology at NETC and the surrounding areas.
>
> The Rhode Island Formation is the most extensive and thickest of the Pennsylvania formations in Rhode Island. The vast majority of the Narragansett Basin is underlain by this formation. Included within the Rhode Island Formation are fine to coarse conglomerate, sandstone, lithic graywacke, graywacke, arkose, shale and a small amount of meta-anthracite and anthracite. Most of the rock is gray, dark gray, and greenish, but the shale and anthracite are often black. Crossbedding and irregular, discontinuous bedding is characteristic of the formation. Rocks of the Rhode Island Formation, which are in the northern portions of the basin, are strong and indurated but are not metamorphosed. However, those rocks in the southern portion of the basin, such as the

NETC, are metamorphosed, and these rocks contain quartz-mica schist, feldspathic quartzite, garnet-stacrolite schist, and some quartz-mica-sillimanite schist. The beds of meta-anthracite and anthracite are mostly thin, but many areas within basin have been mined. Vein quartz, fibrous quartz, and pyrite are commonly associated with these coal layers, and the ash content is high.

Within the Rhode Island Formation, there are a few areas of thick conglomerates. These conglomerate layers are gray to greenish in color and are mostly very coarse. These conglomerates consist of pebbles, cobbles, and boulders (up to several feet long), interbedded with sandstone and graywacke. The stones are predominantly quartzite and have been elongated as a result of tectonic forces in the southern portion of the basin. These thick conglomerate layers are more resistant to erosion than are the surrounding rocks and thus, are topographically higher. Coasters Harbor Island is mostly covered with this conglomerate material.

Throughout the Narragansett Basin, the Pennsylvanian rocks are underlain by pre-Pennsylvanian igneous and metamorphic rocks such as Bulgarmarch granite, Metacom granite gneiss, porphyritic granite and slate and quartzite. For the most part, these basement rocks are deeply buried beneath the Pennsylvanian rocks. However, these older rocks occur north of NETC in the Bristol area and south of NETC in the Fort Adams and Newport Neck areas and on the southern tip of Conanicut Island. Rose Island and Goat Island also have older metamorphic rocks of slate and quartzite.

Overlying the Pennsylvanian rocks of the Narragansett Basin are surficial deposits of Pleistocene sediments. These Pleistocene sediments owe their origin to the Wisconsin glaciation which covered the area with ice several thousand feet thick. As the glaciers receded some 10,000 to 12,000 years ago, they deposited unconsolidated glacial materials of variable thicknesses throughout the Narragansett Basin area. The unconsolidated glacial material ranges from 1 to 150 feet thick, being thicker in the valleys and thinner in the uplands. The glacial material consists of till, sand, gravel, and silt. These glacial deposits were derived from shale, sandstone, conglomerate, and in a few places, coal.

The glacial materials serve as the parent materials for the soils in the area. Areas where sand and gravel were deposited serve as important regional mineral sources. . . .

(IAS, pp. 5-18, 5-21)

Much of the geologic information contained in this section was obtained from Geological Survey Bulletin 1295 (Quinn, 1971). . . .

(IAS, pg. 5-21)

Several soil borings were completed into bedrock as part of a Remedial Investigation conducted at four RI/FS sites within the NETC (TRC, 1991). Bedrock was encountered at four of the RI sites. Generally, the bedrock consisted of a grey-green to black, highly weathered to competent, carboniferous shale. Rock cores indicated a high degree of fracturing with quartz and iron oxide deposits present along the fracture planes. Depth to bedrock varied amongst boring locations from approximately one to 33 feet below ground surface.

Glacial till deposits were encountered overlying the bedrock at NETC during the RI investigations. The till material was characterized as containing fine to coarse sand with varying amounts of silt, with some horizons containing weathered shale fragments. A single Shelby Tube sample of the till indicated a triaxial permeability of 2.7×10^{-7} cm/sec (7.7×10^{-4} feet/day). Natural deposits of sand and silt and organic muck were also encountered.

2.4 Regional Hydrology

The regional hydrology for NETC Newport will be discussed in two following subsections covering surface water and ground water.

2.4.1 Regional Surface Water Hydrology

The regional surface water hydrology for NETC Newport is presented below. Much of the regional information was obtained from the IAS report, and is referenced as such with page numbers which follow the excerpts.

> NETC is located within the Narragansett Bay Drainage Basin. This drainage basin covers an area of 1,850 square miles, 1,030 square miles of which are in Massachusetts and 820 square miles of which are in Rhode Island. All surface water drainage from the basin is into Narragansett Bay. Three major rivers, the Taunton, Blackstone, and Pawtucket, as well as the Providence River and a number of smaller rivers and streams, drain into Narragansett Bay. Discharge from Narragansett Bay is into the Atlantic Ocean between Point Judith and Sakonnet Point in Rhode Island.
>
> Throughout NETC, the surface drainage is westward toward Narragansett Bay with the exception of one area in Tank Farm #2 which drains eastward into Melville Reservoir. Surface drainage at NETC is provided by the Melville Ponds, Normans Brook, Lawton Brook and Reservoir, Gomes Brook, a stream and pond in the northeastern portion of NUSC, and a stream discharging into Coasters Harbor. The surface drainage for NETC is shown in Figure 5.3-6. All these streams discharge into Narragansett Bay. . . .

Waters within a 600 foot radius of Greene Lane, Middletown	SB
The waters in the vicinity of Fort Adams, Newport, which are within a 300 foot radius of the Fort Adams marine outfall sewer (4.1 acres)	SC
The waters in the vicinity of Coasters Harbor which are within 500 feet of the Newport marine outfall sewer (18 miles)	SC

(Rhode Island Water Quality Standards, 1988)

2.4.3 Area Water Use

Public water in the City of Newport and Town of Middletown is supplied and managed by the Newport Water Department. The Town of Portsmouth purchases water from the Newport Water Department but operates its own distribution system. Approximately two thirds of Portsmouth is serviced by public water with the remaining one third supplied water from private water wells. While no specific records exist as to private well use in the information reviewed, in general, the majority of private wells are reportedly located on the eastern portion of Aquidneck Island (Personal Communication, Town of Portsmouth, 1992).

The Newport Water Department receives its water supply from a series of seven surface water reservoirs located on Aquidneck Island and two surface water reservoirs on the mainland. The seven surface water reservoirs on Aquidneck Island are:

1. Lawton Valley Reservoir,
2. St. Marys Pond,
3. Sisson Pond,
4. Easton North Pond,
5. Easton South Pond,
6. Paradise or Nelsons Pond, and
7. Gardners Pond.

Each of these reservoirs is supplied water via rainfall and runoff and is not augmented by ground water supply wells. The Newport Water Department stated that the safe yield of the reservoir system is approximately 11 to 13 million gallons per day (MGD). Water use in 1991 was 7.07 MGD, and adequate capacity reportedly exists for projected water usage on Aquidneck use in 1991 was 7.07 MGD, and adequate capacity reportedly exists for projected water usage on Aquidneck Island for the next ten to twenty years, or more (Personal Communication, Newport Water Department, 1992). Figure 6 indicates the location of surface water reservoirs (Lawton Valley, Sisson Pond, St. Marys Pond, and the Easton North Pond) in the vicinity of the Newport Naval Base.

The Prudence Island Utilities Company supplies ground water to approximately 800 people on Prudence Island, Portsmouth, located east and off-shore of the Melville area.

The locations of known public ground water supply wells and surface water reservoirs within the NETC Newport vicinity are shown on Figures 4 and 5. The locations of ground water supply wells were obtained from the February, 1992 RIDEM Ground Water Section Facilities Inventory map for the Prudence Island quadrangle (USGS). The map shows the locations of known public ground water supply wells, in addition to known or suspected sources of ground water contamination. RIDEM Ground Water Section personnel indicated that the location of the supply wells within the Prudence Island Quadrangle had been field verified by RIDEM personnel.

Private wells are reported to withdraw water from till, bedrock, and stratified-drift aquifers. Of these aquifers, bedrock is considered the most reliable source of ground water, and well yields are commonly sufficient for domestic supplies (Johnston, U.S.G.S., undated).

The location, depth, and yield of private bedrock wells in the Prudence Island and Newport Quadrangles are shown on Figures 5.3.9 and 5.3.10 [Figures 4 and 5] as obtained from the IAS report. The IAS report indicated that bedrock wells in the area range from approximately 14 to 1,300 feet deep. Well yields from 55 gallons per minute (GPM) to less than 1 GPM are reported in the IAS report.

2.4.4 Regional Ground Water Hydrology

The regional ground water hydrology for NETC Newport is presented below. Much of the regional information was obtained from the IAS report, and is referenced as such with page numbers which follow the excerpts.

treatment, agricultural uses, bathing, other primary contact recreational activities, and fish and wildlife habitat. The following is a description of water quality classifications for Narragansett Bay in the NETC area, as obtained directly from the State surface water quality regulations (RIDEM, Division of Water Resources, Section 6 - Water Quality Standards, Appendix A, Narragansett Bay Drainage Basin):

SECTION	CLASSIFICATION
The waters within 500 feet of the firing pier of the US Navy Torpedo Testing Station, Gould Island	SA
The waters in the area easterly from a line drawn from Coggeshall Point southwesterly to the southeastermost point of Dyer Island and the area easterly from a line drawn from Carr Point northwesterly to the southeasternmost point of Dyer Island	SC
The waters in the vicinity of Taylor Point which are within a 300 foot radius of the Jamestown marine outfall sewer (7 acres)	SC
The waters in the vicinity of Taylor Point, exclusive of those waters described above, south of a line from the northernmost extremity of Taylor Point to Can Buoy 13, north of a line from a point of land approximately 1000 feet south of the Newport Bridge to the northernmost extremity of Rose Island, and within 1000 feet of the shoreline of Jamestown (49 acres)	SB
Unnamed Brook from Greene Lane, Middletown, Rhode Island to East Passage, Narragansett Bay (1-1/2 mile)	B
Unnamed Brook upstream of Greene Lane to headwaters	B
East of a line from Ida Lewis Rock to the southern extremity of Goat Island, east of the line from the northern extremity of Goat Island to the west shore of Coasters Harbor Island, east of a line from the west shore of Coasters Harbor Island to the western extremity of Coddington Point and south and east of a line from the southwestern extremity of Coddington Point to the northern most point of the Coddington Cove breakwater	SC
The area within 1000 feet off of Monroe Street (in the Fort Adams Naval housing complex) on the west shore of Fort Adams, east of line from Fort Adams Light to Rose Island Light to Buoy (FLR) Bell 14 and a line from Buoy (FLR) Bell 14 through Nun Buoy 16 at Coddington Point and its extension to the end (southeastern most point) of the Coddington Cove breakwater	SB

Except for the stream and pond at NUSC and the stream which empties into Coasters Harbor, all of the other streams and ponds are on land which is being excessed by the Navy. The Melville Ponds have been disposed of by GSA and are now part of the Melville Public Fishing Area.

While these streams and ponds receive drainage from many of the areas within NETC, a substantial portion of the NETC area drains directly into Narragansett Bay or infiltrates into the soil before reaching a stream or body of water. Direct runoff into Narragansett Bay would especially occur following thunderstorms. . . .

(IAS, pp. 5-26, 5-28)

The potential for pollutant migration by surface drainage at NETC is greatly increased by its proximity to Narragansett Bay. Many of the waste disposal areas, such as the McAllister Point landfill, Melville North disposal site and Gould Island disposal site, are located right along the shoreline of Narragansett Bay. Surface drainage from these areas is directly into the bay. The NETC area is frequently subjected to thunderstorms during which intense periods of rainfall are common. Surface drainage into the bay would be greatest following these thunderstorms.

Pollutants from these portions of NETC drain into the Melville Ponds, Normans Brook, Lawton, Brook, Gomes Brook, and the NUSC stream and would also migrate off-site. All of the streams discharge directly into Narragansett Bay.

(IAS, pg. 5-34)

2.4.2 Regional Surface Water Classifications

The surface water quality classifications for Narragansett Bay, as determined by RIDEM, are shown on Figure 3. Most of the Narragansett Bay is classified as Class SA, which means it is suitable for bathing and contact recreation, shellfish harvesting for direct human consumption, and fish and wildlife habitat.

Areas classified as Class SB are suitable for public drinking water with appropriate treatment, agricultural uses, bathing, other primary contact recreational activities, and fish and wildlife habitat. Areas classified as Class SC are suitable for boating, other secondary contact recreational activities, fish and wildlife habitat, industrial cooling, and good aesthetic value.

Two freshwater streams located on NETC property have been classified as Class B surface waters. Class B surface waters are suitable for public water supply with appropriate

Many areas on Aquidneck Island, on which NETC is located, obtain their water supply from wells. Areas relying on ground water are mostly north of the Middletown area, but there are wells throughout the entire island. Most ground water is used for domestic needs, although some is used by small industries and businesses.

Ground water on Aquidneck Island is obtained from the unconsolidated glacial deposits of till and outwash and from the underlying Pennsylvanian bedrock. Throughout the area, depth to ground water ranges from less than one foot to about 30 feet, depending upon the topographic location, time of year, and character of subsurface deposits. The average depth to the ground water is around 14 feet on Aquidneck Island and moves from areas of high elevations to Narragansett Bay or the Sakonnet River.

Seasonal water level fluctuations are common in the area. These fluctuations range from less than 5 feet to as much as 20 feet on the hills. In the valleys and lowland areas, the fluctuations are generally less than 5 feet. During the late spring and summer, the water table usually declines as a result of evaporation and the uptake of water by plants, and rises during autumn and following winter thaws.

The unconsolidated glacial deposits range in thickness from less than one foot near the rock exposures to about 50 feet throughout Aquidneck Island. Most of the glacial deposits are till, but isolated outwash areas occur. In the NETC area, the glacial deposits are till with a thickness of less than 20 feet. Wells completed in the till are usually dug and range in depth from less than 10 feet to as much as 75 feet. The average depth for these wells is about 20 feet. These dug wells are usually 2 to 3 feet in diameter and are usually dug down to the top of the bedrock.

The yield of till wells varies considerably depending upon the type and thickness of the water-bearing deposits penetrated. Yields range from less than one to as much as 120 gallons per minute. Under normal weather conditions, till wells yield a few hundred gallons of water per day and are adequate for domestic supplies. The large diameter of dug wells also provides substantial water storage area between periods of use. Each foot of water in a 3-foot diameter well represents storage of 53 gallons. However, these wells are subject to going dry during seasonal or unusual droughts.

Bedrock wells in the area range from 14 to 1,300 feet in depth. The average depth for these bedrock wells is 135 feet. Yields from bedrock wells range from less than one to as much as 55 gallons per minute. Most wells yield less than 10 gallons per minute. The yields vary considerably in the bedrock over short distances because the joints and fractures which transmit water to the wells occur intermittently. Joints and fractures are most numerous and widest near the top of the bedrock and become fewer and narrower with depth. Bedrock wells seldom go dry, but yields can be extremely low if not enough fractures and joints occur in the area of the well.

The chemical characteristics of the ground water are similar throughout the area, and the water is generally satisfactory for most ordinary uses. Most ground water in the area is soft or only moderately hard, with ground water from till generally containing less mineral matter and being softer than ground water from bedrock. Areas where the ground water has high iron content are scattered throughout the area, being most numerous around Newport and Middletown and the northern part of Portsmouth. Wells which have a high iron content usually penetrate only rocks of Pennsylvanian age.

In scattered locations near the shoreline, over-pumping has led to salt water intrusion in some wells. Bedrock wells are not as easily contaminated with salt water as are till wells, but the chance of contamination increases as the depth of the well below sea level increases.

No wells were identified within the boundaries of NETC other than on Gould Island, although there are numerous wells in close proximity. These wells are upgradient of NETC. . . .

(IAS, pp. 5-31 to 5-34)

The ground water at NETC is very shallow, being less than 10 feet below the surface in most areas. This shallow depth makes ground water contamination at NETC very possible. Those pollutants which do find their way into the ground water would migrate to the west and discharge into Narragansett Bay. NETC extends along the western shoreline of Aquidneck Island, and the ground water only has to migrate a short distance before discharging into Narragansett Bay.

The soils occurring at NETC have permeabilities which are moderate to moderately rapid, and they do not restrict the vertical movement of water. The glacial till, from which these soils were derived, is generally less permeable than the overlying soils but does not represent a barrier to the vertical migration of water. Therefore, it is possible that any contaminant transported in this water could contaminate the ground water. There are also isolated areas where the bedrock occurs at the surface. Contamination is possible in these areas through the cracks and fissures which commonly occur in the bedrock.

(IAS, pg. 5-34)

Information obtained from the Phase I Remedial Investigations indicated that, in general, ground water on NETC flows from east to west towards Narragansett Bay. Depth to ground water ranged from approximately four to 28 feet below ground surface at the four RI/FS sites. Slug tests conducted on monitoring wells at these sites indicated that the hydraulic conductivity of the till unit ranged from 0.22 to 0.44 feet per day and upper bedrock hydraulic conductivity ranged from 0.029 to 0.21 feet per day. The RI report noted that bedrock test data produced hydraulic conductivities higher than those normally attributed to shale (3.28×10^{-4} to 3.28×10^{-8} feet per day (Driscoll, 1987).

2.4.5 Ground Water Classifications

The Rhode Island Department of Environmental Management (RIDEM) has classified ground water in Rhode Island to protect and restore the quality of the state's ground water resources for use as drinking water and other beneficial uses, and to assure protection of the public health and welfare, and the environment. The ground water under the Melville North Landfill site has been classified as Class GB.

Ground water classified GAA includes those ground water resources which the Director (RIDEM) has designated to be suitable for public drinking water without treatment and which are located in one of the three following areas:

1. Ground water reservoirs and portions of their recharge areas as delineated by RIDEM;

2. A 2,000 foot radius circle around each community water system well or within the delineation of a wellhead protection area to each well delineated by RIDEM;

3. Ground water dependant areas, such as Block Island, that are physically isolated from reasonable alternative water supplies and where the existing ground water supply warrants the highest level of protection.

Ground water classified GA is known or presumed to be suitable for drinking water without treatment. Ground water classified GB may not be suitable for drinking water without treatment due to known or presumed degradation. GB classified ground water is primarily located at highly urbanized areas or is located in the vicinity of disposal sites for solid waste, hazardous waste or sewerage sludge. Areas which are unclassified are presumed by RIDEM to be Class GA ground water.

Non-attainment (NA) areas are those areas which are known or presumed to be out of compliance with the standards of the assigned classification. The goal for non-attainment areas is restoration to a quality consistent with the classification.

The RIDEM Ground Water Quality Regulations were codified into Rhode Island law in May 1992 (Regulation DEM-GW-01-92, May 1992). Figure 6 indicates the relative location of the RI/FS sites and RIDEM ground water classes.

3.0 HISTORY OF RESPONSE ACTIONS

This section presents a brief chronology of the interaction between the Rhode Island Department of Environmental Management (RIDEM), other regulators, and NETC Newport concerning environmental issues at the Naval base.

3.1 Chronology of Regulatory and Navy Actions

The following chronology pertinent to NETC Newport site investigations was obtained from the IAS report, the Confirmation Study, the Draft Tank Closure Plan for Tanks 53 and 56, the Phase I RI/FS and a review of information in RIDEM files:

Mid-1960's - burning of oil tank bottom sludges discontinued because of air pollution regulations.

Unknown Date - all of NETC shoreline closed to shellfishing due to concerns about bioaccumulation of contaminants in Narragansett Bay from sites on the facility.

Post 1971 - required scrubbers were installed on the Navy's classified document incinerator.

September 11, 1980 - the Navy Assessment and Control of Installation Pollutants (NACIP) program was initiated. The purpose of the program is to systematically identify, assess, and control environmental contamination from past use and disposal of hazardous substances at Navy and Marine Corps installations. (Note: This study is being conducted under this program.)

1982 - the RIDEM adopted hazardous waste regulations which classified waste oil as a hazardous waste.

March 1983 - Initial Assessment Study (IAS) of NETC completed.

1984 - the Navy ceased using Tanks 53 and 56 at Tank Farm Five for waste oil storage.

1986 - the RIDEM implemented new regulations for the operation and closure of underground storage tanks used to hold oils and hazardous materials.

May 1986 - Confirmation Study Report (CS) on the NETC was completed.

1988 - Tank Closure Plan for Tanks 53 and 56 located at Tank Farm Five completed and closure option selected for implementation.

1991 - Phase I RI/FS Report on five sites at the NETC was completed.

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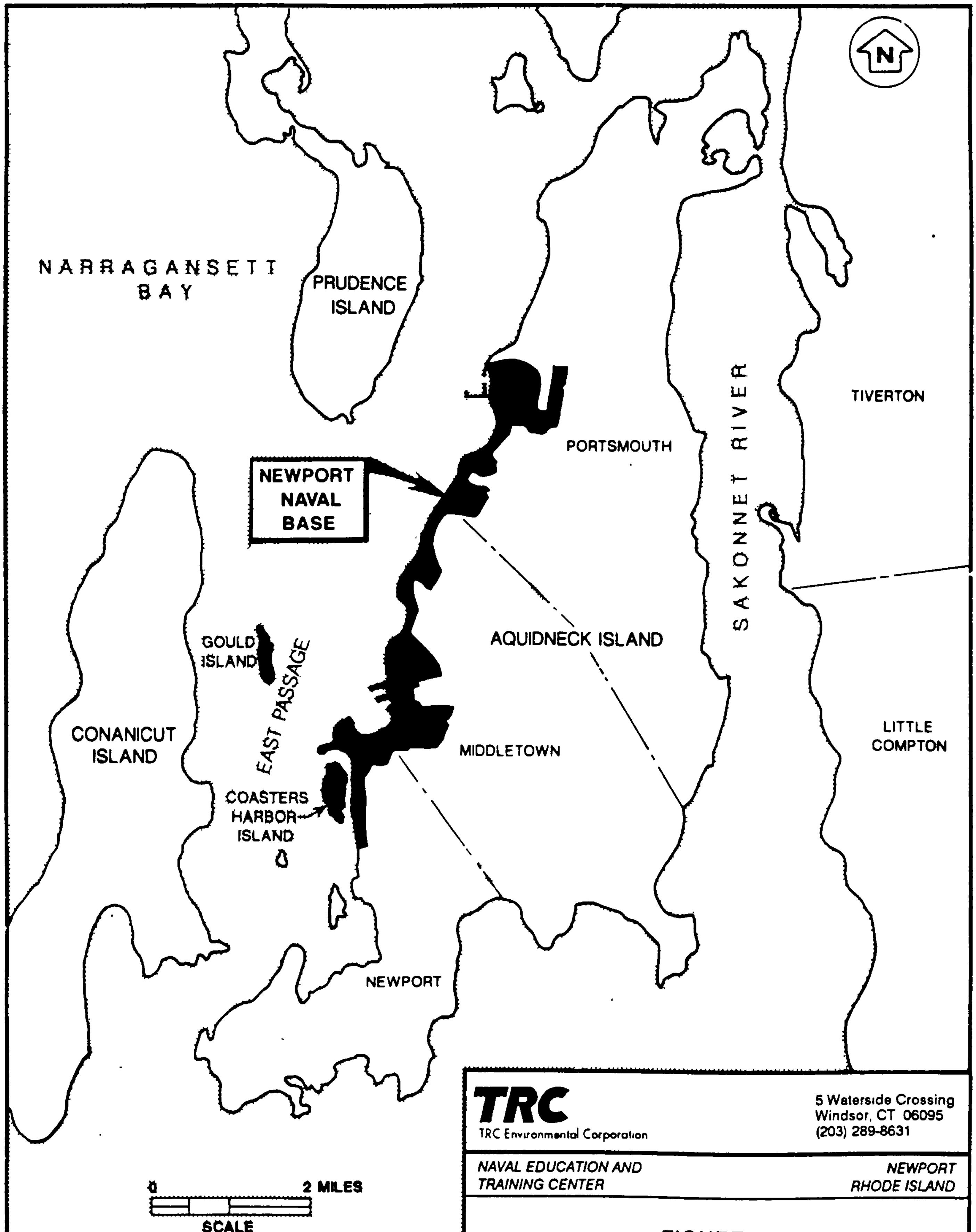
FIGURES



SOURCE: INITIAL ASSESSMENT STUDY
(ENVIRODYNE, 1983)

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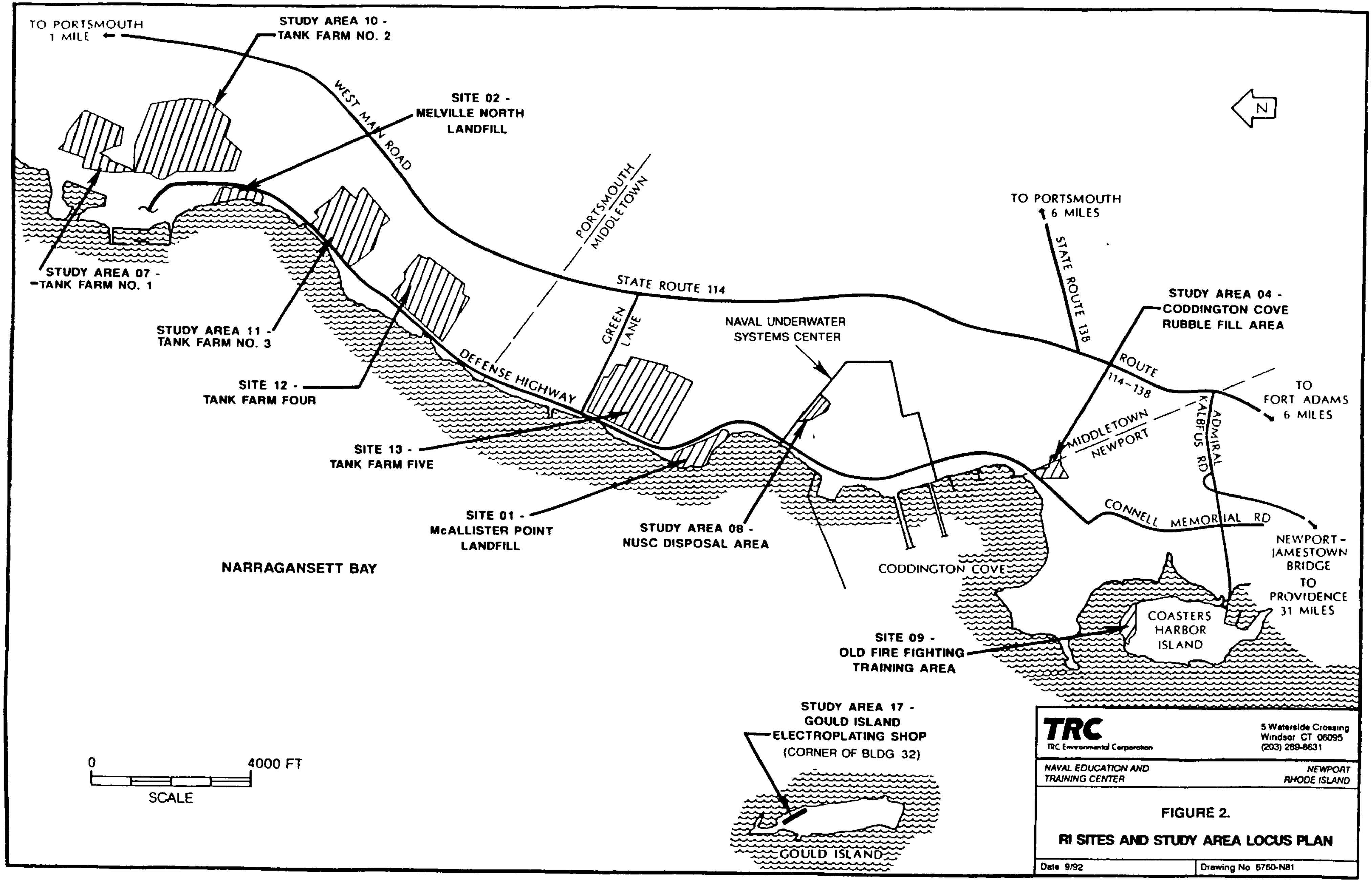
NAVAL EDUCATION AND TRAINING CENTER

NEWPORT RHODE ISLAND

FIGURE 1.

SITE LOCUS

Date 9/92	Drawing No 6760-N81



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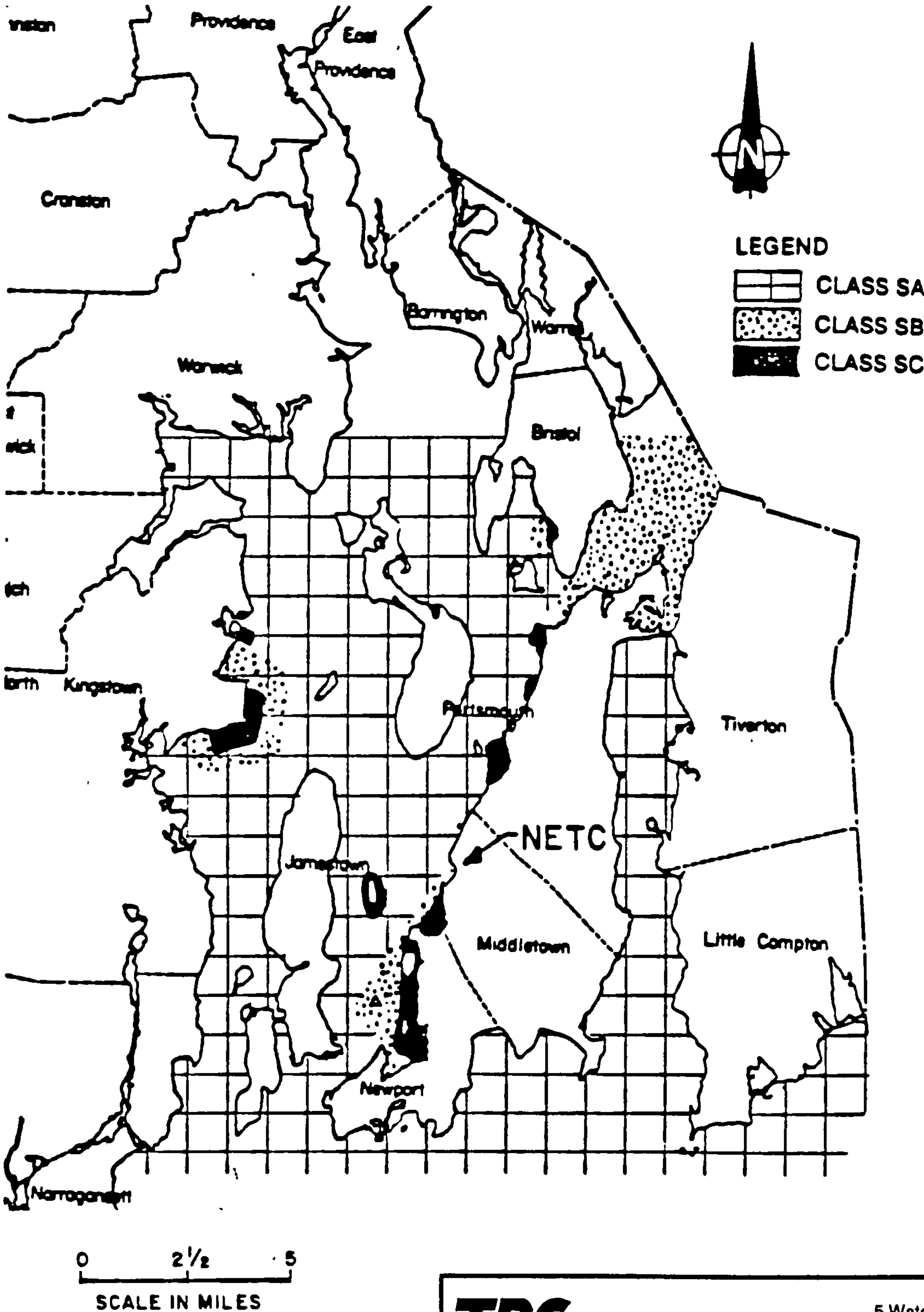
NAVAL EDUCATION AND TRAINING CENTER — NEWPORT RHODE ISLAND

FIGURE 2.

RI SITES AND STUDY AREA LOCUS PLAN

Date 9/92 | Drawing No 6760-N81



SOURCE. FIGURE 5.3-8 OF 1983 IAS REPORT (ENVIRODYNE)

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FIGURE 3.

SURFACE WATER QUALITY MAP OF NARRAGANSETT BAY

Date 9/92	Drawing No 6760-N81

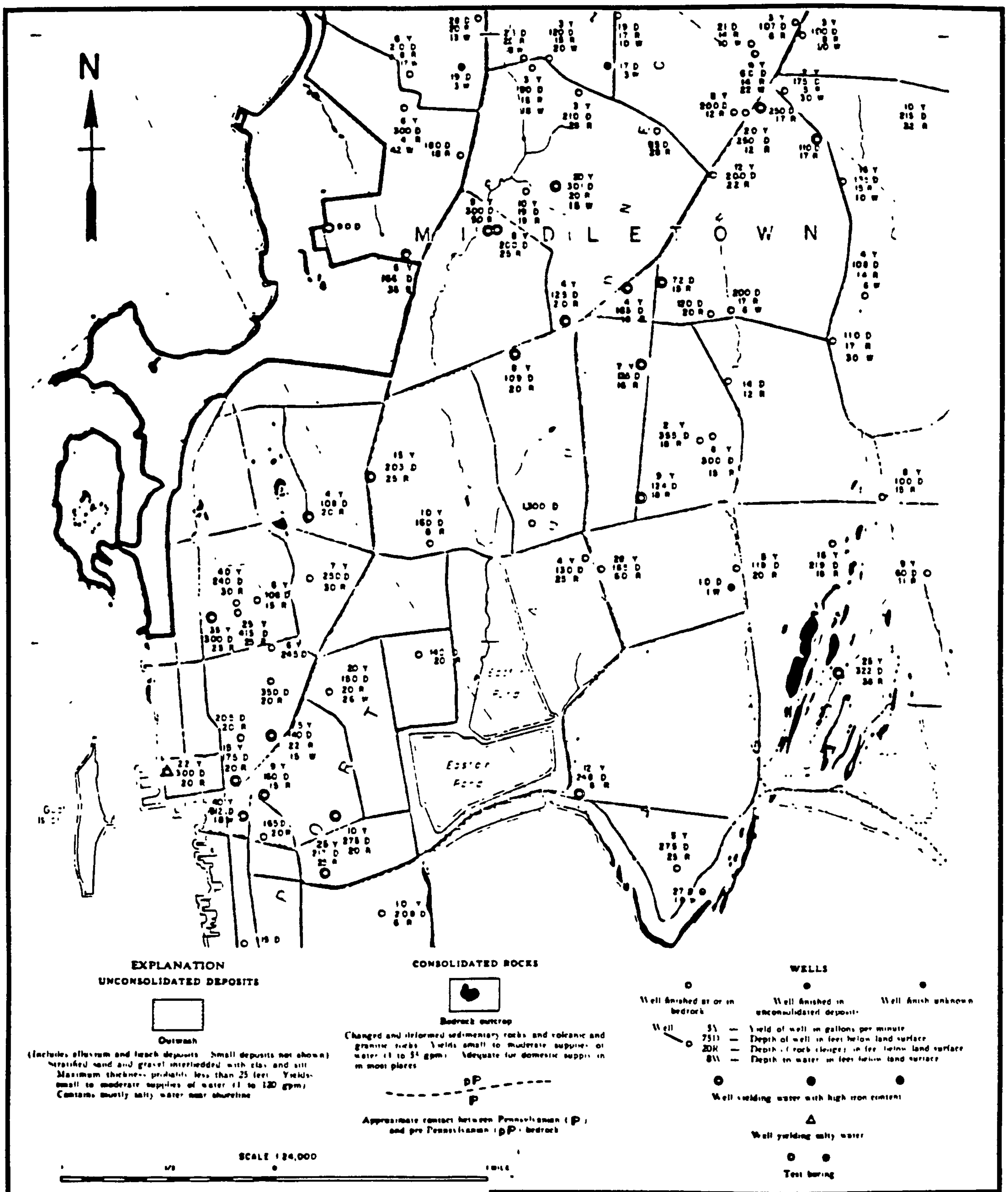

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FIGURE 4.

BEDROCK WELL MAP A

Date 9/92

Drawing No : 6760-N81

SOURCE: FIGURE 5 3-9 OF 1983 IAS REPORT (ENVIRODYNE)

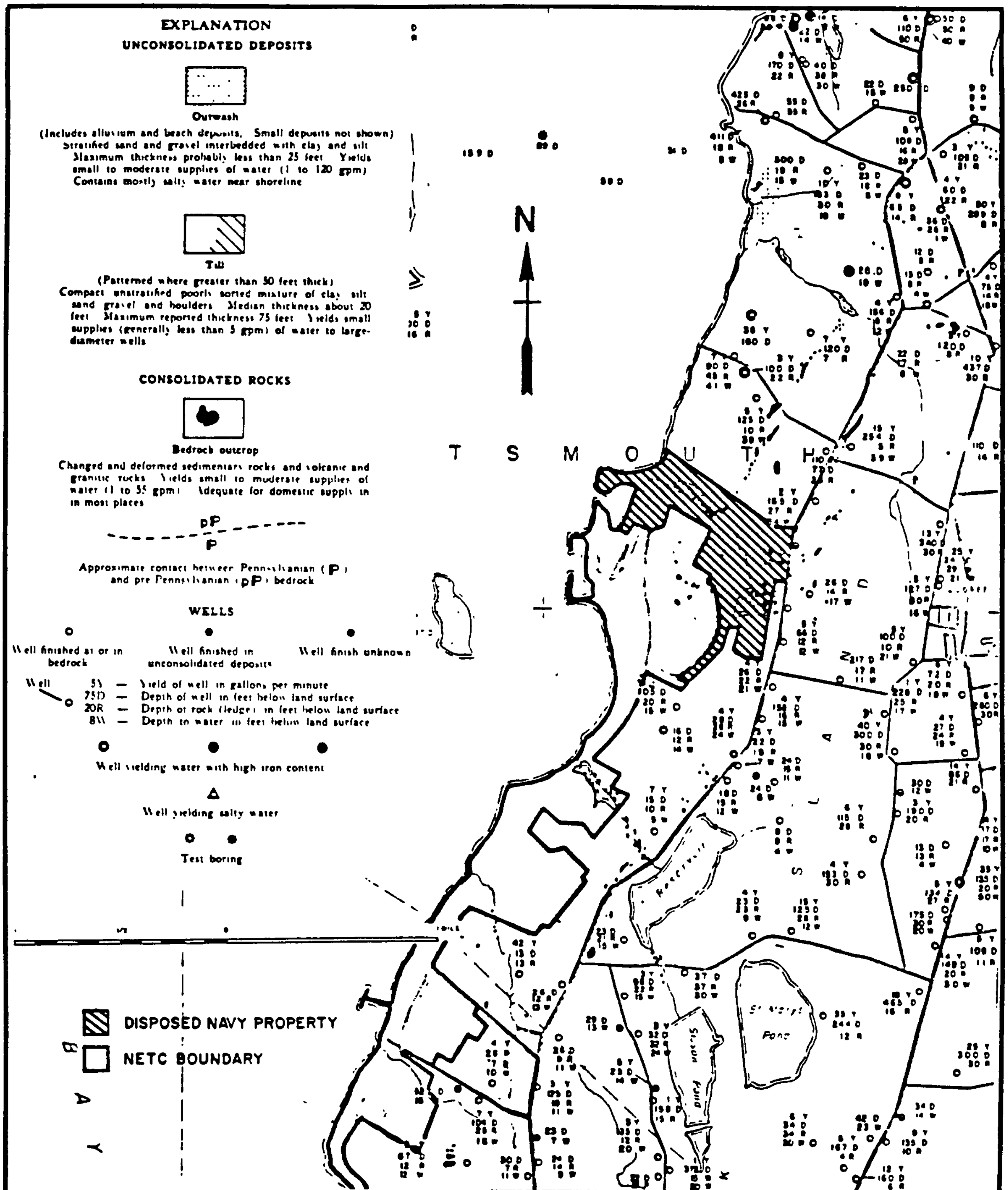

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FIGURE 5.

BEDROCK WELL MAP B

Date: 9/92 | Drawing No.. 6760-N81

SOURCE: FIGURE 5 3-10 OF 1983 IAS REPORT (ENVIRODYNE)

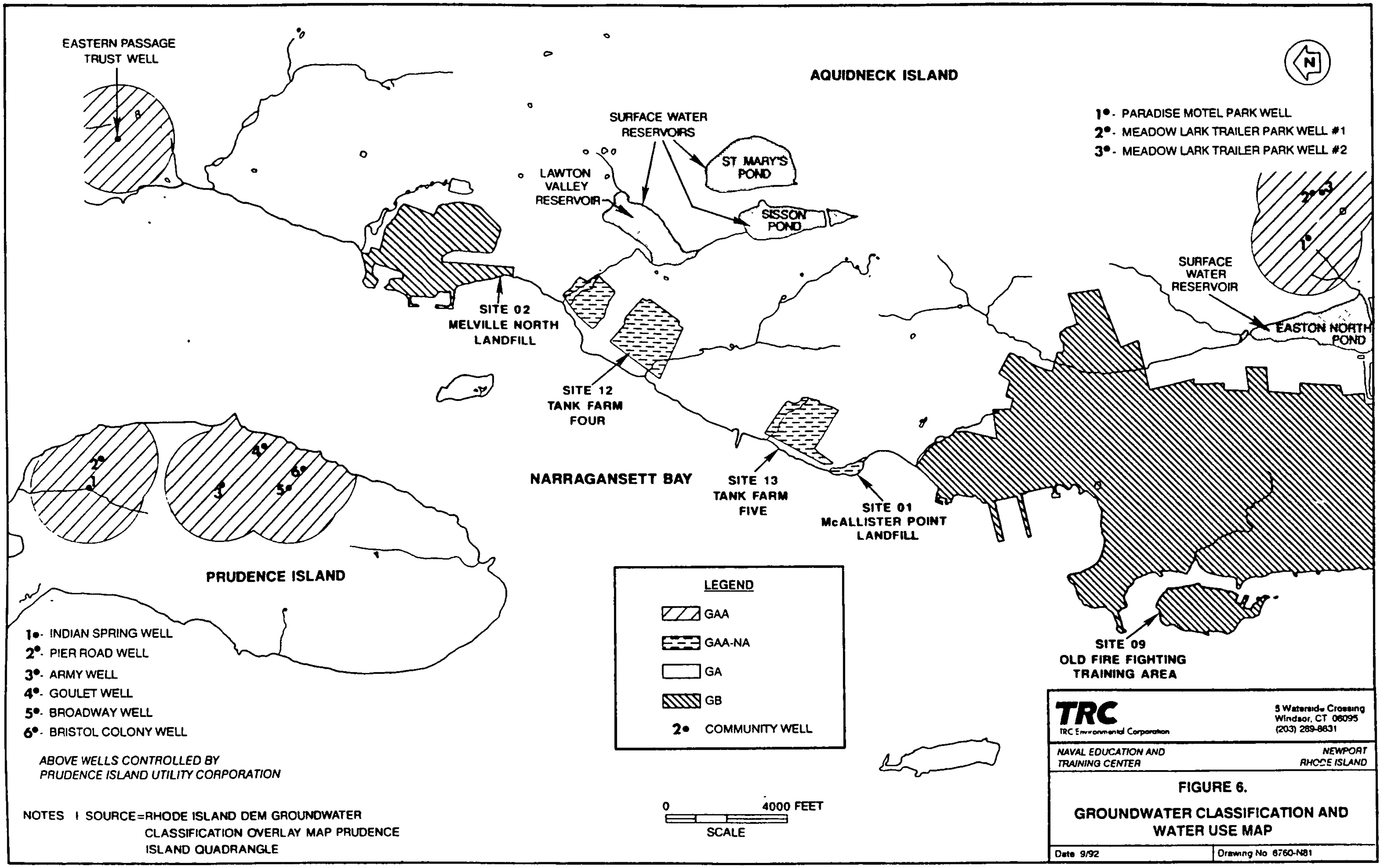

FIGURE 6.
GROUNDWATER CLASSIFICATION AND WATER USE MAP

TABLES

TABLE 1
SUMMARY OF NETC HAZARDOUS WASTE SITES

No.	Site	Characteristics/Studies/Plan of Action
1	McAllister Point Landfill	1955 - 1970s - The landfill received all waste generated at the Newport Naval Complex. This site contains wastes from operation (machine shops, electroplating, etc.), Navy housing, and ships homeported in Newport. Materials disposed of at this site would be mostly domestic-type refuse but also include spent acids, paints, solvents, waste oils (lube, diesel, and fuel), and PCB-contaminated oil. An IAS and CS were conducted of the site. Site will be investigated under the current RI/FS.
2	Melville North Landfill	WWII - 1955 - The landfill received mostly domestic-type refuse and also spent acids, waste paints, solvents, waste oils, and PCBs. Several areas are covered with oil and oily sludge on the site. The site has been excessed and is owned by Melville Marine Industries. An IAS and CS were conducted of the site. Site will be investigated under the current RI/FS.
3	Structure #214 - Melville North	1980 - 1982 - Substation #214. The site has been excessed. NETC cleaned the site under a removal action.
4	Coddington Cove Rubble Fill	1978 - 1982 - Rubble dump which contains inert items including scrap lumber, tires, wire, cable, and empty paint cans. An IAS conducted of the site recommended no further action.
5	Melville North Area	1978 - 1982 - Twenty barrels of waste oil stored on an asphalted area. Oil was spilled in the area. The site has been excessed. An IAS was conducted of the site. NETC cleaned the site under a removal action.
6	STP Sludge Drying Bed	1982 - 1983 - Site is located in Melville North at the old sewage treatment plant. Oily waste has been disposed of at this site. Site has been excessed. An IAS was conducted of the site. NETC cleaned the site under a removal action.
7	Tank Farm #1	WWII - 1970 - Located in Melville North. Contains six 60,000-barrel underground storage tanks (USTs) for diesel oil, fuel oil, jet fuel, 100 octane gasoline, and aviation fuel. Tank bottom sludge generated from cleaning the tanks was placed in on-site pits. Approximately 6,000 gallons of sludge was disposed of at the site. An IAS and CS were conducted of the site. The performance of an RI/FS is dependent upon the results of the RI/FS conducted at two other tank farms (Sites 12 and 13).

TABLE 1
SUMMARY OF NETC HAZARDOUS WASTE SITES

(Continued)

No.	Site	Characteristics/Studies/Plan of Action
8	NUSC Disposal Area	Early 1970s - Located in Coddington Cove. Contains rubble, inert materials including scrap lumber, tires, wire, cable, and empty paint cans. An IAS conducted on the site recommended no further action.
9	Old Fire Fighting Training Area	WWII - 1972 - Located on Coaster's Harbor Island. Waste oils were used at the site to train personnel in fire fighting operations. Site has been excavated to remove contaminated soils. An IAS conducted of the site recommended no further action. Oil discovered at the site during a recent geotechnical investigation for the expansion of an operating facility on the site indicated the need for further investigation of the site. The site will be investigated under the current RI/FS.
10	Tank Farm #2	WWII - 1970 - Located in Melville. Contains eleven 60,000-barrel USTs for fuel. Approximately 100,000-175,000 gallons of sludge were disposed in on-site pits. An IAS was conducted of the site. The performance of an RI/FS is dependent upon the results of the RI/FS conducted at two other tank farms (Sites 12 and 13).
11	Tank Farm #3	WWII - 1970 - Located in Melville. Contains seven 60,000-barrel USTs for fuel. Tank sludge bottoms were disposed in burning chambers. The burning chambers had steel sides and sand bottoms. An IAS was conducted on the site. The performance of an RI/FS is dependent upon the results of the RI/FS conducted at two other tank farms (Sites 12 and 13).
12	Tank Farm #4	WWII - 1970 - Located in Melville. Contains twelve 60,000-barrel USTs for fuel. Approximately 100,000-190,000 gallons of tank sludge bottoms were disposed of on-site. An IAS and CS were conducted of the site. Site will be investigated under the current RI/FS.
13	Tank Farm #5	WWII - 1970 - Located in Midway. Contains eleven 60,000-barrel USTs for fuel. Tank bottom sludge was burned on-site. Approximately 100,000-175,000 gallons of oily sludge were disposed of on-site. A tank closure investigation was conducted for two USTs at the site. An IAS was conducted of the site. Site will be investigated under the current RI/FS.

TABLE 1
SUMMARY OF NETC HAZARDOUS WASTE SITES

(Continued)

No.	Site	Characteristics/Studies/Plan of Action
14	Gould Island Disposal Area	WWII - All wastes generated on the island consisting of domestic trash, metal scrap, wood, pipes, rusted drums, two diesel oil tanks, and concrete. Wastes from electroplating and degreasing operations may also have been disposed of at the site. An IAS and CS were conducted of the site. Site will be investigated by the Army Corps of Engineers.
15	Gould Island Bunker #11	WWII - Site had drums containing possible hazardous waste from electroplating operations. An IAS was conducted on the site. NETC cleaned the site under a removal action.
16	Gould Island Incinerator	WWII - Six-ton capacity incinerator. No action required at site.
17	Gould Island Electroplating Shop	WWII - Wastes generated from electroplating and degreasing operations. Wastes included muratic acid, chromic acid, copper cyanide, sodium cyanide, sodium hydroxide, nickel sulfate, Anodex cleaner and degreasing solvents. Site has been excessed. An IAS and CS were conducted of the site. NETC cleaned the site under a removal action.
18	Structure #214 - Melville North	1980 - 1982 - Area adjacent to Structure #214. Drums of waste oil and oily spillage. Site has been excessed. NETC cleaned the site under a removal action.

TABLE 2

STATUS SUMMARY OF NETC HAZARDOUS WASTE SITES

No.	Site	Present Owner	Action
1	McAllister Point Landfill	Navy	IAS/CS, RI/FS
2	Melville North Landfill	Private	IAS/CS, RI/FS
3	Transformer Vault Structure #214 - Melville North	Private	Navy Clean-Up
4	Coddington Cove Rubble Fill	Navy	IAS, SASE(1)
5	Melville North Area	Private	IAS, Navy Clean-up
6	STP Sludge Drying Bed	Private	IAS, Navy Clean-up
7	Tank Farm #1	Navy	IAS/CS, SASE(1)
8	NUSC Disposal Area	Navy	IAS, SASE(1)
9	Old Fire Fighting Training Area	Navy	IAS, RI/FS(2)
10	Tank Farm #2	Navy	IAS, SASE(1)
11	Tank Farm #3	Navy	IAS, SASE(1)
12	Tank Farm #4	Navy	IAS/CS, RI/FS
13	Tank Farm #5	Navy	IAS, RI/FS
14	Gould Island Disposal Area	Navy(5)	IAS/CS, RI/FS(3)
15	Gould Island Bunker #11	Navy(5)	IAS, Navy Clean-Up
16	Gould Island Incinerator	Navy(5)	No Action
17	Gould Island Electroplating Shop	Navy(5)	IAS/CS, SASE(1)
18	Structure #214 - Melville North	Private	IAS, Navy Clean-Up

(1) A Study Area Screening Evaluation (SASE) will be performed on each of these sites to determine need for an RI/FS.

(2) During a geotechnical investigation of the site, evidence of oil-contaminated soil was found. Therefore, the site is being studied under the RI/FS.

(3) Site #14 will be investigated by the Army Corps of Engineers (ACE).

(4) Sites are proposed to be excessed.

(5) The southernmost property on Gould Island which includes Sites 14-17 has been excessed by the Navy but this section of the island has not been accepted by the State of Rhode Island.

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

VOLUME II
PROJECT PLAN

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared For:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

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1.0 INTRODUCTION

The Plan of Action presented in the Phase II RI/FS Work Plan was prepared in accordance with Navy Requirements (Scope of Work, Amendment 20 to Appendix "A", Contract N62472-86-C-1282) and Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA prepared by USEPA (1988). The Work Plan builds on the data base available for the Naval Education and Training Center, Newport (NETC-Newport), Rhode Island. The data base includes the following major environmental investigation efforts:

- Initial Assessment Study (IAS), Envirodyne Engineers, Inc. (1983).
- Verification Step, Confirmation Study (CS), Loureiro Engineering Ass. (1986).
- Draft Final Report - Phase I (RI), TRC Environmental Consultants Inc. (1991).

The Phase II Work Plan was developed to provide site-specific information sufficient to support informed risk management decisions regarding any necessary or appropriate site remedies.

In preparing the Phase II Work Plan, pertinent comments received by the Navy on the Draft Phase I Remedial Investigation Report (December 1991) were incorporated into the Phase II plan of action. The Phase I RI report included those from the USEPA Region I and the U.S. Fish and Wildlife (29 pages, January 27, 1992), USEPA (additional 5 pages, February 11, 1992), USEPA risk assessment (February 6, 1992), USEPA follow-up responses (June 12, 1992), and RIDEM (24 pages, January 24, 1991). Additionally, comments received on the Phase I - RI/FS Work Plan from USEPA (19 pages, September, 18 1990) and RIDEM were addressed, as appropriate.

The project plans for the Phase II work effort include the site-specific Field Sampling Plan (FSP), a Quality Assurance Project Plan (QAPP), and a project Health and Safety Plan (HASP). In addition, this Work Plan includes discussions of NETC and site-specific background information which has been updated to include the results of the Phase I RI, a discussion of ARARs and preliminary action alternatives, a Data Evaluation and Assessment Plan which addresses data management and the RI Report outline, and a supplemental Human Health Risk Assessment. A discussion of treatability studies and pilot testing is also included in the Treatability Study and Feasibility Study (FS) Plan.

The Phase II Work Plan was developed to assure that the field investigations meet the objectives described in EPA's RI/FS guidance, including:

- Define the nature and extent of contamination (waste types, concentrations, distributions).
- Provide a basis for the evaluation of contaminant fate and transport mechanisms.
- Update Phase I Human Health Risk Assessment.
- Perform an Ecological Risk Assessment.
- Update Phase I identification of federal/state contaminant- and location-specific ARARs.
- Provide a data base sufficient to support the detailed evaluation of remedial alternatives within a Feasibility Study.

In developing the Work Plan, the approach was to:

- Identify data gaps in the Phase I RI;
- Identify data quality objectives (DQO's);
- Identify types of actions that may be appropriate for addressing site problems and define associated data requirements for the technical evaluation of the actions' applicability;
- Identify interim remedial measures, where appropriate, to mitigate potential threats or prevent further environmental degradation;
- Identify optimal sequence of site actions and site activities; and
- Identify procedures that may be used to streamline the RI/FS.

2.0 PROJECT PLAN CRITERIA

2.1 Data Gaps

The Phase I RI provided an initial evaluation of the presence, nature, and extent of contamination at the Melville North Landfill site. Surface soils, subsurface soils or fill, sediment, and ground water were sampled and initially characterized at the site. Geologic and hydrogeologic characteristics of the site were also investigated. A Human Health Risk Assessment was performed for the site on the basis of the Phase I RI results. However, the site was not "fully characterized" by the Phase I investigation activities. Based upon a review of all existing data and regulatory review comments, the following data gaps or issues were identified as requiring further investigation (site activities planned to address these data gaps are noted in parenthesis after each item):

- Background Soil and Ground Water Quality (off-site surface soil samples and upgradient monitoring wells).
- Extent of Phase I Detected Surface Soil Contamination.
- Extent of landfill and site (surface soil samples and soil borings).
- Characteristics of fill materials and subsurface soils (surface soil samples and soil borings).
- Site Bedrock Topography (soil borings and geophysics).
- Ground Water Quality in Shallow and Bedrock Aquifers (nested monitoring well sampling).
- Extent of Phase I Detected Ground Water Contamination (soil gas and monitoring wells).
- Extent of Site (surface soil samples and borings).
- Overall Site Surface Soil Quality (surface soil samples).

Additional site characterization activities at the site includes the collection of samples for media treatability information (e.g., grain size analyses, TOC, etc.).

2.2 Data Quality Objectives (DQOs)

The development of data quality objectives for this site investigation involves the following:

- the specification of the decision making process and identification of why new data are needed based on the identification of data users, the evaluation of existing data, the development of conceptual site models, and the specification of data quality objectives for the project;

- the identification of data uses or needs to ensure adequate data are developed; and

- the specification of methods by which data of acceptable quality and quantity will be obtained.

Project objectives include the further characterization of the site with respect to the nature and extent of contamination, the chemical and physical characteristics of the site, the site contaminant fate and transport concerns, the human health and ecological risks, and the application of potential remedial alternatives.

The Phase II RI/FS Work Plan has been developed in consideration of the following data quality objectives. The data developed during the Phase II RI will need to be of sufficient quality to support the activities involved in meeting the project objectives (i.e., data evaluation, risk assessment, treatability study and feasibility study activities). The USEPA guidance provided in "Data Quality Objectives for Remedial Response Activities" (USEPA, March 1987) was used to determine the analytical levels required to support the site characterization activities. Table 1 provides information on the analytical levels appropriate to various data uses. Table 2 identifies appropriate analytical levels for generic RI/FS data uses. The data quality objective levels to be utilized for this investigation include:

Level I - screening - organic vapor detection using field instruments for soil gas surveys and health and safety monitoring;

Level II - field analysis for soil gas surveys;

Level III - engineering (laboratory analyses other than EPA CLP, such as physical soil tests);

Level IV - Confirmational (such as TCL, TAL, including data validation); and

Level V - Non-standard (including analysis for non-conventional parameters like TOC, BOD, TPH, and modified CLP methods).

The combined use of these data quality objective levels will satisfy the data requirements of site characterization, risk assessment, and feasibility study activities.

2.3 Sequenced Site Actions/Activities

The Phase II Remedial Investigation described in the Work Plan will be conducted in a staged approach in which sampling and analyses are sequenced to direct and optimize subsequent field activities. Visual, ambient air, and soil gas surveys will be used to further evaluate potential locations for the placement of borings and monitoring wells. Surface and subsurface soil samples will be collected to define the nature and extent of soil and fill contamination. Ground water samples will be collected and analyzed to define the horizontal and vertical extent of ground water contamination. Other field activities to be accomplished as part of the Phase II RI include hydrogeologic well testing and supplemental geologic characterization. A summary of the field investigation activities planned for the Phase II RI at the Melville North Landfill are as follows:

- Geophysical Survey (seismic refraction),
- Soil Gas Surveys (portable gas chromatograph),
- Surface Soil Sampling,
- Test Borings,
- Monitoring Well Installation,
- Ground Water Sampling, and
- Hydraulic Well Testing

2.4 Streamlining of Phase II - RI/FS Activities

The results of the Phase I RI and background data indicated that additional field investigations are needed to fill in the data gaps, further address Phase I investigation findings, and address regulatory requirements documented in review comments. To streamline Phase II RI/FS activities, existing data has been evaluated to determine if interim actions can be taken at the site. These activities include the collection of analytical data during the Phase II RI which will aid in the evaluation of remedial technologies, and the planned interactive process for identifying potential treatability study needs and conducting treatability studies, as described in Volume VIII of this Work Plan. The project planning for Phase II has developed a cost-effective approach which will ensure that adequate data are available for defensible Human Health and Ecological Risk Assessment and Feasibility Study.

Streamlining the RI/FS approach for the Melville North Landfill site recognizes that removal of all uncertainties is usually not feasible and focuses instead on collecting sufficient data to characterize the site to support site remedy selections. It is critical that sufficient data is collected during the Phase II RI to either support a "no action" finding or allow the Navy to proceed toward the ultimate goal of site clean-up.

TABLES

TABLE 1

SUMMARY OF ANALYTICAL LEVELS APPROPRIATE TO DATA USES

DATA USES	ANALYTICAL LEVEL	TYPE OF ANALYSIS	LIMITATIONS	DATA QUALITY
SITE CHARACTERIZATION MONITORING DURING IMPLEMENTATION	LEVEL I	• TOTAL ORGANIC/INORGANIC VAPOR DETECTION USING PORTABLE INSTRUMENTS • FIELD TEST KITS	• INSTRUMENTS RESPOND TO NATURALLY-OCCURING COMPOUNDS	• IF INSTRUMENTS CALIBRATED AND DATA INTERPRETED CORRECTLY, CAN PROVIDE INDICATION OF CONTAMINATION
SITE CHARATERIZATION EVALUATION OF ALTERNATIVES ENGINEERING DESIGN MONITORING DURING IMPLEMENTATION	LEVEL II	• VARIETY OF ORGANICS BY GC, INORGANICS BY AA; XRF • TENTATIVE ID; ANALYTE-SPECIFIC • DETECTION LIMITS VARY FROM LOW ppm TO LOW ppb	• TENTATIVE ID • TECHNIQUES/INSTRUMENTS LIMITED MOSTLY TO VOLATILES, METALS	• DEPENDENT ON QA/QC STEPS EMPLOYED • DATA TYPICALLY REPORTED IN CONCENTRATION RANGES
RISK ASSESSMENT PRP DETERMINATION SITE CHARACTERIZATION EVALUATION OF ALTERNATIVES ENGINEERING DESIGN MONITORING DURING IMPLEMENTATION	LEVEL III	• ORGANICS/INORGANICS USING EPA PROCEDURES OTHER THAN CLP CAN BE ANALYTE-SPECIFIC • RCRA CHARACTERISTIC TESTS	• TENTATIVE ID IN SOME CASES • CAN PROVIDE DATA OF SAME QUALITY AS LEVELS IV, NS	• SIMILAR DETECTION LIMITS TO CLP • LESS RIGOROUS QA/QC
RISK ASSESSMENT PRP DETERMINATION EVALUATION OF ALTERNATIVES ENGINEERING DESIGN	LEVEL IV	• HSL ORGANICS/INORGANICS BY GC/MS; AA; ICP • LOW ppb DETECTION LIMIT	• TENTATIVE IDENTIFICATON OF NON-HSL PARAMETERS • SOME TIME MAY BE REQUIRED FOR VALIDATION OF PACKAGES	• GOAL IS DATA OF KNOWN QUALITY • RIGOROUS QA/QC
RISK ASSESSMENT PRP DETERMINATION	LEVEL V	• NON-CONVENTIAL PARAMETERS • METHOD-SPECIFIC DETECTION LIMITS • MODIFICATION OF EXISTING METHODS • APPENDIX 8 PARAMETERS	• MAY REQUIRE METHOD DEVELOPMENT/MODIFICATION • MECHANISM TO OBTAIN SERVICES REQUIRES SPECIAL LEAD TIME	• METHOD-SPECIFIC

TABLE 2

APPROPRIATE ANALYTICAL LEVELS - BY DATA USE

DATA USE / ANALYTICAL LEVEL	SITE CHARACTERIZATION (INCLUDING HEALTH & SAFETY)	RISK ASSESSMENT	EVALUATION OF ALTERNATIVES	ENGINEERING DESIGN OF REMEDIAL ACTION	MONITORING DURING IMPLEMENTATION OF REMEDIAL ACTION	PRP DETERMINATION	OTHER ______
LEVEL I	✓				✓		
LEVEL II	✓		✓		✓		
LEVEL III	✓	✓	✓	✓	✓	✓	
LEVEL IV		✓	✓	✓		✓	
LEVEL V		✓		✓		✓	
OTHER				✓			

NOTE: CHECK APPROPRIATE BOX (ES)

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U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

VOLUME III
FIELD SAMPLING PLAN

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Philadelphia, Pennsylvania

-Draft-
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1.0 INTRODUCTION

The objective of this volume of the Work Plan is to define the level of Phase II investigation necessary to assess the nature and extent of environmental contamination at Site 02, the Melville North Landfill site located on the NETC. This volume of the Work Plan describes site-specific objectives in Section 1.1, summarizes available site background information in Section 2.0, presents the site-specific field sampling activities in Section 3.0, and summarizes site-specific health and safety information in Section 4.0.

1.1 SITE-SPECIFIC INVESTIGATION OBJECTIVES

The general objectives of the RI site investigation are to determine the nature and extent of site contamination, sources of contamination, potential contaminant migration pathways, potential contaminant receptors, and associated exposure pathways. This information is necessary to determine whether, and to what extent, a threat to human health or the environment exists, and to provide the information required to develop and evaluate remedial action alternatives for the site, as necessary.

The scope of the Phase I and Phase II sampling efforts for this site have been developed to meet site-specific RI/FS objectives. The site-specific objectives have been refined based upon the findings of the Phase I RI. Below is a list of the RI objectives for the Melville North Landfill investigation:

- determine the background levels of soil and ground water quality;
- determine the nature and extent of site surface soil contamination;
- determine the extent of the fill material on the site;
- determine the nature of the fill material contamination;
- determine the nature and extent of ground water contamination;
- determine the source location of the ground water contamination;
- determine the nature and extent of sediment and biota contamination in the adjacent bay.

The Phase II site investigation is being conducted to address areas of concern discovered under the Phase I investigation and any site investigation data gaps. The Phase II investigation activities will include soil gas surveys, surface soil sampling, soil boring sampling, and monitoring well installation and sampling. Soil and ground water samples will be collected from the site and analyzed as described in Section 3.0 of this plan.

2.0 SITE BACKGROUND INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The Melville North Landfill is located at the northern end of the Newport Naval Base (see Figure 1). The site is approximately 8 acres in size and is situated between Defense Highway and Narragansett Bay. A set of Penn Central Railroad tracks run in an approximate north-south direction on the eastern side of the site. Access to the site is off of Defense Highway through a small gate and along a paved entrance way. The paved entrance way leads approximately 180 feet down a small hill and across the railroad tracks to the site. A map of the site is presented on Figure 2.

The site is relatively flat across the central to northern portions. In the southern portion of the site a slight ridge runs along the eastern half of the site. At the northern end of the site is a waste pile area which covers approximately 6,000 square feet and is approximately 5 feet above grade at its highest point. Ground elevations across the main portion of the site vary between approximately 10 and 20 feet above mean sea level. Along the western edge of the site, the grade of the site is nearly level with the shoreline. As you proceed from the site to Defense Highway there is an increase in elevation of approximately 40 feet.

The site is vegetated with grass, weeds, and some small trees. A strip of small trees is present along the edge of the bay in the west-central portion of the site. A small, more densely wooded area is present along the edge of the bay in the southern portion of the site. Just off of the site, a wooded area is present along the central to southern edge of the site, between the site and Defense Highway. The Navy routinely clears vegetation along the overhead power lines which run along the eastern edge of the site.

2.2 SITE HISTORY

The Melville North Landfill site was investigated in both the IAS and CS. The following site history information was obtained from the IAS report.

> This site was used as a landfill for at least the period following World War II until 1955. The date that the site first began to be used as a landfill is unclear, but all indications are that it was after the war. Following its closure in 1954, wastes generated at the naval complex were disposed of at the McAllister Point Landfill. The site encompasses approximately 10 acres.
>
> The Melville North Landfill would have received wastes similar to those which were disposed of in McAllister Point Landfill, including spent acids, waste paints, solvents, waste oils (diesel, fuel, lube) and, potentially, PCBs. The quantity of these wastes disposed of in the landfill is unknown. During visual inspections of the site, areas covered with oil and oil sludge were found to be scattered throughout the site. There were mounds of oil-soaked soil which appeared to have been trucked to the site and dumped. These oil-contaminated mounds could be the oil sludge material obtained from the tank farms during tank cleaning operations, or the result of cleanup operations following oil spills.
>
> The site is situated in the Melville North area in a low-lying wetland type area along the shoreline of Narragansett Bay, as shown in Figure 1-2 [see Figure 1]. The area is subject to periodic flooding and lies within the 100-year flood plain (NETC Master Plan, 1980). This site is located on land which is being excessed by the Navy and is pending final disposal by GSA.

(IAS, pg. 6-34)

The site was excessed by the Navy in September 1983 to the State of Rhode Island. Six months later, the site was sold to Melville Marine Industries. The planned development for the site is a marina.

2.2.1 Aerial Photography

Aerial photos and facility maps were reviewed for the period from 1938 through 1988. Activity on the site dates back to 1951, where lagoons and a structure which could be a building or tank are visible on the site. In a 1953 photo, a lagoon appears to be emitting smoke from its surface. Areas of ponded water are visible at various locations throughout the site from 1951 until 1975. In an undated photo estimated to have been taken between 1970 and 1975, two obviously man-made impoundments are visible along the northern spur of the site access road (see Figure 1-3).

2.3 PREVIOUS SITE INVESTIGATIONS

An Initial Assessment Study (Envirodyne Engineers, 1983) conducted on the site in 1983 identified areas on NETC where potential contamination from past waste disposal or handling practices may pose human health or environmental risks. The Melville North Landfill site was reviewed under the IAS. Based upon the historic use of the site as a landfill for hazardous wastes and the potential contaminant migration pathways at the site, the site was recommended for a Confirmation Study (CS).

A CS was conducted at this site from 1984 to 1985. The CS at this site involved the collection of sediment and mussel samples and a composite soil sample from a mound of oil-saturated soils, and the excavation of test pits to determine the depth of oil-contaminated soils. The soil sample collected from the oily waste deposits contained over 3% petroleum hydrocarbons by weight, as well as an elevated level of lead. Based on the test pit activities, no lateral or downward migration of oil from the waste deposits is evident. Metals levels detected in sediment samples and PCB levels detected in mussel samples appeared to be similar to background levels and not attributable to site-specific contamination.

The Phase I Remedial Investigation (RI), which was conducted from 1989 to 1990, included site geophysical surveys, surface soil sampling, soil boring sampling, and ground water sampling. The findings of the Phase I RI for the Melville North Landfill site are presented below.

Soil Assessment - Volatile organic compounds (VOCs), base neutral/acid extractable organic compounds (BNAs) (including polynuclear aromatic hydrocarbons (PAHs)), pesticides, PCBs, and inorganics were all detected in on-site soils. The major areas of the site where contaminants were detected in the soils at elevated levels include the following:

- Northwestern area - BNAs, PCBs;
- Northeastern area - PCBs, inorganics;
- North-central area - inorganics;
- Central area - VOCs, BNAs, pesticides, PCBs and inorganics; and

South of access road - VOCs, BNAs, PCBs, and inorganics.

Significant VOC contamination (i.e., greater than 1 ppm total VOCs) was detected in subsurface soils in the central portion of the site, in the suspected area of former lagoons, and in the southern portion of the site at well boring 4. Soil samples collected in the former lagoon area and from well boring 4 generally exhibited strong petroleum odors and/or visible oil contamination. BNAs were detected at elevated levels (i.e., greater than 10 ppm total BNAs) in the northwest, central and southern portions of the site.

Pesticides were detected at low levels (i.e., 10's of ppb) in surface soil samples across the site with higher levels (100's of ppb) detected in the central portion of the site. PCBs were detected in surface and subsurface soils. PCBs were detected above the 1 ppm RIDEM PCB soil action level in surface soils in the northwest and northeast portions of the site, and in subsurface soils in the central and southern portions of the site.

Inorganics were detected in soil samples collected from the northeast corner of the site to just south of the site access road at levels exceeding background levels. The highest inorganic levels were detected in subsurface soils generally collected at or below the water table from the north-central and central to south-central portions of the site.

Ground Water Assessment - VOCs, BNAs, pesticides, PCBs, and inorganics were all detected in ground water samples. The major areas of the site where contaminants were detected at levels exceeding action levels include the following:

- North-central area - inorganics;
- Central area - VOCs, and inorganics; and
- South of access road - VOCs, BNAs and PCBs.

VOC detections at concentrations exceeding ground water action levels, consisting mostly of petroleum-related VOCs (xylene, benzene), were limited to wells located in the central (MW-3) and southern (MW-4) portions of the site. Oil was identified in well MW-3. VOCs were also detected in soil boring samples collected at the depth of the water table from the central and southern portions of the site, and signs of petroleum related contamination (e.g., odors, oil) were observed during the drilling and sampling of these borings. One BNA compound was detected above ground water action levels in a well (MW-4) in the southern portion of the site. A pesticide, gamma-BHC, was detected in ground water at well MW-4. A PCB concentration of 40 ppb was also detected in well MW-4 (PCBs were detected in the soil from this well boring). PCBs were also detected at 0.13 ppb, less than the MCL, in MW-3 in the central portion of the site. While inorganic concentrations exceeded ground water action levels in most wells, the highest levels of inorganic analytes were detected in ground water in the central to north-central portions of the site.

Sediment Sample Assessment - VOCs, BNAs, pesticides, and inorganics were detected in sediment samples. The sediment samples were collected from the swampy area at the northern edge of the site. The contaminants detected at elevated levels in the sediment included carcinogenic PAHs, pesticides, and inorganics

The maximum total VOC concentration detected in the sediment was 11 ppb, well below the contaminant-comparison level of 1 ppm. The maximum total BNA concentration detected was 5.43 ppm, also below the contaminant-comparison level of 10 ppm. However, total carcinogenic PAH levels in two samples exceeded the contaminant-comparison level of 1 ppm. Pesticides were detected in each of the sediment samples, with 4,4'-DDE detected at each location at concentrations ranging from 7.9 to 470 ppb. Inorganic analytes were detected at elevated concentrations at each sample location, although different analytes exceeded background at each location.

2.4 SITE GEOLOGY

The Phase I soil boring activities performed under this investigation provided information on the site geology. The subsurface soil investigation activities included the drilling and sampling of thirteen (13) test borings and five (5) well borings across the site. Shallow test pits were also completed in the central portion of the site. The locations of the borings, wells, and test pits are shown on Figure 4.

The overburden material on this site consists of fill and glacial till deposits. All of the Phase I borings completed at the site, with the exception of test borings B-1, B-10, and off-site well boring M-5, encountered fill material. The thickness of fill varied from 2 feet (B-2) at the edge of the site, to 10 feet (B-5 and M-2) in the central portions. The fill material encountered consisted primarily of loose, black, medium to coarse sand and gravel, with some shale fragments. Ash, wood, and metal debris were also encountered in many of the borings as well as in the test pits. Oily fill was encountered in several borings (B-4, B-13, M-3) and test pits (TP-1 and TP-5), all located in the central portion of the site, as well as in B-9, located to the south-west.

Glacial till deposits were observed beneath the fill across the site. The till encountered on this site consisted primarily of silt, with up to approximately 50% fine to coarse sand in places. The greatest thickness of till encountered at the site was 16 feet (in well boring M-4).

Although none of the soil borings completed at the site penetrated bedrock, fragments of weathered shale were encountered in the bottom of many of the borings (B-5, B-6, B-9, M-1, M-2, and M-5). Those borings may indicate a close proximity to the overburden-bedrock boundary. The shale fragments closely resembled the bedrock encountered at the McAllister Point Landfill site. Based upon these observations, it is inferred that the Melville North Landfill is underlain by the same shale unit (the Rhode Island Formation) as the McAllister Point Landfill.

2.5 SITE HYDROLOGY

The following is a discussion of the site surface water and ground water hydrology.

Surface Water Hydrology

No distinct surface water bodies are present on the Melville North Landfill site. There is, however, a wetlands area present along the northern edge of the site. The general site topography slopes in an east to west direction. East of the site is a flat area (railroad track location), beyond which a very steep grade rises up to Defense Highway. Narragansett Bay borders the site along its western edge. Some topographically low areas are present on the site where water ponds during rainfall events. A small marshy area is also present in the north-central portion of the site.

Surface water on the site (precipitation or runoff from higher surrounding elevations) either evaporates, infiltrates into the site soils, ponds on site or flows overland to lower surrounding elevations or Narragansett Bay. The edge of the site is at an elevation nearly level with the beach shoreline along the bay, which may allow for surface water runoff to the bay.

Ground Water Hydrology

Ground water levels were measured in the five monitoring wells installed at the site in July and September of 1990, and in January of 1991. A representative contour map of the ground water table elevation is presented as Figure 3. The ground water contours indicate that the site ground water is flowing from east to west towards the bay.

Single well hydraulic conductivity tests (slug tests) were performed at three of the monitoring wells at the site (MW-1, MW-2, and MW-5). Monitoring wells MW-1 and MW-5 are both screened in the till overburden, and MW-2 is screened in fill. The hydraulic conductivities determined for the till were 0.24 ft/day (MW-1) and 0.22 ft/day (MW-5S). The hydraulic conductivity of the fill material at MW-2S was determined to be 0.45 ft/day. This indicates that the fill at the site is approximately 2 times as conductive as the till.

Horizontal Hydraulic Gradients

Horizontal hydraulic gradients were determined from the Phase I RI/FS investigation water level measurements at the site. Average horizontal gradients ranged from 0.0027 ft/ft (MW-3 to MW-4) to 0.033 ft/ft (MW-5 to MW-2).

Average Linear Velocities

The calculated average horizontal hydraulic gradients, along with hydraulic conductivity and effective porosity values, were used to calculate average linear velocity values at the site. A hydraulic conductivity of 0.31 ft/day, an average of the hydraulic conductivities determined by the slug tests performed at the site, was used in the calculations. An effective porosity of 15% was assumed for the till at the site (Driscoll, 1986).

Average linear velocities of the shallow ground water ranged from 0.0053 ft/day (MW-3 to MW-4) to 0.0654 ft/day (MW-5 to MW-2). It is important to note that the above calculated average linear velocity values are lower than the "true microscopic velocities" because water particles must travel along irregular paths that are longer than the linearized paths represented by the calculated average linear velocities (Freeze and Cherry, 1979). In addition, the estimated effective porosity value of 15% for the till at the site may be too high or low, causing the linear velocity estimates to be too low or high, respectively.

Tidal Influence

Continuous water level measurements were recorded in four of the five monitoring wells at the site (MW-1, MW-2, MW-4, and MW-5), for three days (August 14 to August 17, 1990). Water levels were recorded every 15 minutes during the three-day time period. Tidal influences were seen in all of the monitoring wells except the most upgradient well MW-5. The maximum fluctuations of the ground water table were 0.31, 0.25, and 0.29 feet for MW-1, MW-2, and MW-4 respectively. No gauging station was constructed at Melville North to measure the tidal fluctuation in the bay during this time period. Although a six-hour tidal fluctuation is evident in the ground water elevation data.

3.0 SAMPLING PLAN

3.1 INTRODUCTION

The program of investigation described in this section has been developed to achieve both overall and site-specific project objectives. Field sampling methodology for individual investigation activities (e.g., soil gas survey, surface soil sampling) is described in Appendix B. The quality assurance/quality control procedures for field sampling and laboratory analyses are presented in the project Quality Assurance Project Plan (QAPP) provided in Appendix D. A summary of the Phase II Melville North Landfill sampling program is presented in Table 1. The planned Phase II sample locations are shown on Figure 6.

3.2 RECONNAISSANCE SURVEYS

Prior to initiating sampling activities a site walkover will be conducted by field investigation team members to familiarize themselves with the current site conditions. The site will be visually surveyed with respect to any changes in site access restrictions, the Phase I monitoring well locations, and the planned Phase II sampling locations. Site-specific health and safety considerations, including emergency evacuation procedures, will be reviewed during the visit. Pertinent features, such as overhead and subsurface utilities, and other potential hazards will also be reviewed with Navy personnel with respect to affected sampling activities.

During the site walkover survey, a Phase II baseline ambient air survey will be conducted across the site. The ambient air survey will be conducted with either a flame or photo-ionization detector to assess ambient conditions for the presence of volatile organic compounds (VOCs) and establish the Phase II site baseline conditions. The ambient air surveys will be completed using equipment and methods outlined in the Field Sampling Methodology Plan provided as Appendix B of this Work Plan.

3.3 GEOPHYSICAL SURVEYS

A seismic refraction survey is planned at this site. In Phase I, EM and magnetometer surveys were completed on a 50-foot spaced grid across the site. The Phase II seismic survey will be used to further aid in determining the extent of site fill and the site bedrock topography.

The specifications of the seismic refraction survey will be determined during a preinvestigation site meeting with the geophysical subcontractor.

3.4 SOIL GAS SURVEY

A soil gas survey is planned at this site to aid in investigating areas of subsurface volatile organic compound soil and ground water contamination discovered in Phase I. The soil gas survey will be conducted on the 25-foot concentric grid pattern around Phase I well nests MW-3 and MW-4. It is estimated that approximately fifteen (15) soil gas points will be sampled around each well nest. As is necessary, additional soil gas survey points will be completed around points indicating elevated concentrations of soil gas to locate "hot spots".

The soil gas survey will be conducted with a van-mounted hydraulic probe device and field gas chromatograph (GC). The portable GC will be used to identify the concentrations of individual VOCs and a total VOCs concentration. The soil gas sampling and analysis methodology is presented in the Field Sampling Methodology discussion provided in Appendix B of this Work Plan.

3.5 SOIL SAMPLING

Soil samples will be collected as surface soil samples and soil boring samples under this site investigation. Below is a discussion on each of the planned soil sampling activities.

3.5.1 Surface Soil Sampling

Surface soil samples will be collected from eight (8) locations on the site. The planned locations of the surface soil samples are shown on Figure 7. These samples will be collected from the following general locations: around areas of documented Phase I soil contamination, surface soil areas not sampled in Phase I, and the site boundaries. The rationale for each of the planned surface soil samples is presented in Table 2.

In addition, two (2) "background" surface soil samples will be collected from two locations east of the site across Defense Highway. An attempt has been made to select background soil sample locations believed to be representative of site background soil conditions and away from other potential sources of contamination (e.g., roadway, railroad tracks). The proposed locations for the background samples will be confirmed with the EPA and RIDEM during a site visit prior to the surface soil sampling activities.

Surface soil sampling will be conducted according to the method described in the Field Sampling Methodology Plan provided in Appendix B of this Work Plan.Surface soil samples will be analyzed for the full organic target compound list (TCL) and inorganic target analyte list (TAL).

Surface soil samples will also be collected from each of the planned test and well boring locations, as described in Section 3.5.2 of this plan. The 0- to 1-foot portion of the first 2-foot split spoon sample will be collected as the surface soil sample at each boring location. The soil boring samples will also be analyzed for the full TCL/TAL.

3.5.2 Soil Boring Sampling

Test borings will be completed and sampled at twelve (12) locations across the site. In addition, soil samples will be collected from the Phase II site well borings planned at nine (9) different well locations. The planned test boring and monitoring well locations are shown on Figures 8 and 9, respectively.

Test borings are planned to further investigate the characteristics of the fill and soil at the site and the extent of subsurface soil contamination detected in Phase I. The Phase II test boring rationale is presented in Table 3. The well borings are associated with the Phase II ground water monitoring wells planned for the site. The Phase II monitoring well rationale is discussed in Section 3.6 and presented in Table 4.

The planned test boring and well locations may be reassessed based upon any significant findings of the site geophysical and soil gas surveys. If these preliminary surveys indicate other more optimum locations for investigating subsurface soil and ground water contamination (e.g., higher VOCs, major anomaly), the test borings and/or well will be relocated to investigate any such locations. The findings of the geophysical and soil gas surveys (e.g., anomalies, detected VOCs) will be reviewed with EPA and RIDEM prior to initiating the test boring investigation.

Soil samples will be collected continuously from the on-site soil borings to the depth of competent bedrock (estimated on-site to be approximately 20 feet below ground surface). Split spoon soil samples will be screened with an OVA and HNu immediately upon being opened.

A 10-foot Nx core of the bedrock will be collected at each of the planned four bedrock well locations. Well borings completed at well locations planned for only a shallow well will be tremie backfilled with a cement/bentonite, as necessary, for the placement of a well screen which intercepts the ground water table.

A minimum of two soil samples will be collected from each of the on-site soil borings for the full TCL/TAL analysis. The two soil samples which will be submitted for laboratory analysis will include the soil samples collected from the 0- to 2-foot interval (the 0- to 1-foot portion for analysis) and from the last sample interval of the observed fill material. If signs of potential contamination (e.g., oil, stains, odors) are observed in a boring, a third sample will also be collected from the depth of greatest observed contamination (i.e., most stained or oily, highest OVA/HNu reading). If no fill material or signs of potential contamination are observed in a boring, only the surface sample and sample from directly above the water table will be submitted for laboratory analysis. Only the surface interval (0- to 1-foot) sample will be collected for analysis at the three off-site well boring locations.

In addition, to the soil samples collected for chemical analyses, a soil sample from just below the depth of the water table (i.e., within the saturated zone) will also be collected from each well location for total organic carbon (TOC) analysis, cation exchange capacity analysis, and grain size determination. The information from these tests will be used in evaluating ground water treatment options.

Geologic descriptions and other sample characteristics (e.g., stains, odors) and observations (e.g., OVA/HNu readings, depth to water) will be recorded in a field notebook.

3.6 GROUND WATER SAMPLING

Monitoring wells were installed at five locations in Phase I (MW-1 through MW-5). Shallow ground water table wells were installed at each of the locations. In Phase II, a total of twelve (12) monitoring wells are planned at nine (9) new locations. In addition, one bedrock well will be installed at a Phase I shallow well location (MW-5).

The planned Phase II well locations consist of six (6) shallow ground water table wells, three (3) shallow ground water table wells paired with bedrock wells, and one (1) bedrock well paired with an existing Phase I shallow well. Generally, the monitoring wells are planned to further assess the nature and extent of ground water contamination detected at the site in Phase I. The planned locations of the monitoring wells are shown on Figure 9. In general, the monitoring wells are located to determine the ground water quality upgradient of the site, the ground water quality at the downgradient edges of the site, the extent of site ground water contamination. The rationale for each of the planned well locations is provided in Table 4.

Ground water samples will be collected from each of the monitoring wells. Wells will be developed after installation. Water levels will be measured in the wells after development and just prior to well purging. The procedures for well development, purging, and sampling are provided in the Field Sampling Methodology Plan provided in Appendix B.

Ground water samples will be analyzed for the full TCL/TAL and total chloride. Five of the ground water samples (three shallow and two bedrock) will also be field filtered for dissolved metals analysis, and analyzed for BOD, COD, and total suspended solids for ground water treatability information. In addition, the temperature, pH, conductivity, dissolved oxygen, redox potential, alkalinity, and salinity of each ground water sample will be measured in the field immediately following sample collection.

In addition to collecting ground water samples from the monitoring wells and obtaining routine water level measurements, single well hydraulic conductivity testing (i.e., slug tests) will be performed on several of the site monitoring wells. Slug tests will be performed on site monitoring wells to aid in determining the characteristics of the site aquifers. The hydraulic wells tests will be performed on all bedrock wells and for those shallow wells with sufficient water for such a test.

3.7 LAND SURVEY

Following completion of field sampling activities the site will be surveyed by a State of Rhode Island registered surveyor. The location and elevation of the Phase II sampling points will be determined in the survey. Each sampling location will be referenced to the State of Rhode Island Grid Coordinate System. Completed monitoring wells will be surveyed for elevation at the top of the protective casing, top of the well casing, and adjacent land surface. Elevations will be referenced to mean low water (mlw) and a United States Geological Survey benchmark. The Phase II survey information will be incorporated on the Phase I site map.

4.0 SITE-SPECIFIC HEALTH AND SAFETY SUMMARY

4.1 INTRODUCTION

The purpose of this health and safety summary is to summarize the site-specific health and safety information. This section describes the nature of wastes or contamination suspected and present at the site, the site access and work zones, and the initial level of personnel protection and monitoring planned for each site investigation activity. In addition, a list of site emergency contacts and a map of the route to the Newport Hospital from the site is provided as Table 5 and Figures 10, respectively.

4.2 NATURE OF WASTES

Historical information indicates that the Melville North Landfill was used for the disposal of wastes, including spent acids, paints, solvents, oils, and PCB-contaminated oils. The Phase I RI findings indicates the presence of elevated levels of volatile organic compounds, polynuclear aromatic hydrocarbons, PCBs, and metals in site soils. The highest levels of VOCs, BNAs, and metals were generally detected in the central and southern portions of the site; oily subsurface soils were observed in both of these site areas.

Nearly all of the Phase I borings completed at the site encountered fill material. The thickness of fill varied from 2 feet at the edge of the site, to 10 feet in the central portions. The fill material encountered consisted primarily of loose, black, medium to coarse sand and gravel, with some shale fragments. Ash, wood, and metal debris were also encountered in many of the borings as well as in the test pits. Oily fill was encountered in several borings and test pits, all located in the central and southern portions of the site.

4.3 SITE ACCESS/WORK ZONES

This site will be divided into three designated contiguous work zones: a support zone, a personnel decontamination area, and an exclusion zone. The support zone for this site will be the company vehicles used by the field investigation crew. The vehicles will be located along the on-site road, just west of where it crosses the railroad tracks. The vehicles will provide temporary relief from any adverse weather conditions and will store necessary field sampling and safety/emergency equipment (e.g., car phone, first aid kit, drinking water, HASP). The command center for the RI activities will be at the portable field office trailer located on Site 13, Tank Farm Five.

A contamination reduction station, or personnel decontamination area, will be established adjacent to the support zone in a designated area. All personnel exiting the exclusion zone (work area) must pass through the decontamination zone prior to entering the support zone vehicles or leaving the site. Personnel shall undergo appropriate decontamination, as required by the activity-specific procedures and level of personnel protection. The heavy equipment decontamination (e.g., for drill rigs, augers, rods) will be conducted at an area established on Site 01, the McAllister Point Landfill, in Phase I. Split spoon decontamination will occur in a designated area adjacent to the field office trailer on Tank Farm Five.

The exclusion zone shall consist of the entire site area located outside of the support zone, support zone corridor, and decontamination areas. Access to the exclusion zone shall be restricted by first passing through the decontamination and support zones, signing in on the daily site log, and donning the appropriate level of personnel protective equipment. At off-site well drilling locations, the exclusion zone will consist of at least a 25-foot exclusion zone around active drill rig operations. This exclusion zone will be demarcated with caution tape or barricades.

The OSC or alternate will be responsible for keeping nonessential personnel outside of the exclusion zone boundaries during the investigation activities. In the event that authorized visitors are present on the site during field activities, the OSC or designee shall insure that they adhere to site safety requirements and maintain a safe distance outside of the exclusion zone. All personnel allowed to enter the exclusion zone shall be required to follow safety procedures described in the project HASP in Appendix C and directions of the OSC.

Disposal of field-generated materials is described in the Investigation Derived Waste Plan provided in Appendix E of this Work Plan.

4.4 PERSONNEL PROTECTION AND MONITORING

Based on the findings of the Phase I RI and suspected site contaminants, the field investigation activities will be initiated in either Modified Level D or Level C personnel protection (as defined in the HASP in Appendix C). A list of anticipated initial levels of personnel protection for each of the specific investigation activities is presented in Table 6. Levels of personnel protection will be upgraded or downgraded as conditions dictate.

During field sampling activities, continuous monitoring of ambient air will be conducted with an OVA and HNu. During drilling activities, continuous ambient monitoring of combustible gas levels will also be conducted with an LEL/O2 meter. Air monitoring will also be performed "downhole" during drilling activities.

TABLES

TABLE 1

SITE 02 – MELVILLE NORTH LANDFILL
SITE INVESTIGATION SUMMARY

ACTIVITY / SAMPLE MATRIX	SCOPE OF WORK	NUMBER OF SAMPLES	SAMPLE ANALYSIS
<u>GEOPHYSICS</u> Seismic Refraction	Multiple traverses	NA	NA
SOIL GAS	2 areas	30 Points	NA
SURFACE SOIL	10 Locations	10	TCL/TAL
TEST BORINGS	12 Locations	24 – 36	TCL/TAL
WELL BORINGS	9 Borings	18 – 27	TCL/TAL
GROUND WATER	12 wells at 9 new locations: 6 shallow wells, 3 shallow/bedrock wells, & 1 bedrock well	17 (1 per Phase II well + 5 existing wells)	17 TCL /22 TAL

Note: "NA" indicates that activity is not applicable.
TCL indicates sample will be analyzed for Target Compound List.
TAL indicates sample will be analyzed for Target Analyte List.
In addition to dissolved (filtered metals), five ground water samples will also be analyzed for BOD, COD, and TSS for treatability information.

TABLE 2

Site 02 - Melville North Landfill
Surface Soil Location / Rationale

SAMPLE NUMBER	LOCATION / RATIONALE
SS-16	Further characterize surface soil quality at the southern end (boundary) of Site 02.
SS-17	Determine background surface soil quality for Site 02.
SS-18	Determine background surface soil quality for Site 02.
SS-19	Determine extent of PCB contamination of surface soils in the northern end of Site 02.
SS-22	Determine extent of PCB contamination of surface soils in the northern end of Site 02.
SS-23	Determine extent of PCB contamination of surface soils in the northern end of Site 02.
SS-24	Determine extent of PCB contamination of surface soils in the northern end of Site 02.
SS-25	Further characterize surface soil quality in the north central (former waste pile area) portion of Site 02.
SS-26	Further characterize surface soil quality in the north central (former waste pile area) portion of Site 02.
SS-27	Further characterize surface soil quality in the north central (former waste pile area) portion of Site 02.

TABLE 3

Site 02 - Melville North Landfill
Test Boring Location / Rationale

BORING NUMBER	LOCATION / RATIONALE
B-14	Determine the extent of PCB contamination at the northern end of Site 02.
B-15	Determine the extent of PCB contamination at the northern end of Site 02.
B-16	Determine the extent of PCB contamination at the northern end of Site 02.
B-17	Determine the extent of PCB contamination at the northern end of Site 02.
B-18	Determine the extent of PCB contamination at the northern end of Site 02.
B-19	Characterize subsurface soil/fill quality in the north central portion of Site 02.
B-20	Characterize subsurface soil/fill quality in the north central portion of Site 02.
B-21	Determine the extent of soil contamination in the central portion of Site 02.
B-22	Determine the extent of soil contamination in the central portion of Site 02.
B-23	Determine the extent of soil contamination in the central portion of Site 02.
B-24	Determine the extent of soil contamination in the south central portion of Site 02.
B-25	Determine the extent of soil contamination in the south central portion of Site 02.

TABLE 4

Site 02 - Melville North Landfill
Monitoring Well Location / Rationale

WELL NUMBER	LOCATION / RATIONALE
MW-5R	Investigate bedrock ground water quality upgradient of the northern portion of Site 02.
MW-6S/R	Investigate ground water quality upgradient of the southern portion of Site 02.
MW-7S	Investigate ground water quality at the northern end of Site 02.
MW-8S	Further investigate ground water quality in the north central portion of Site 02.
MW-9S	Investigate ground water quality upgradient of the north central portion of Site 02.
MW-10S/R	Investigate ground water quality, at the edge of the site, downgradient of contamination detected in the central portion of Site 02 during the Phase I investigation.
MW-11S	Investigate ground water quality in the vicinity of contamination detected during the Phase I investigation at B-9.
MW-12S	Further investigate ground water contamination detected in monitoring well MW-4 during the Phase I investigation.
MW-13S/R	Further investigate ground water contamination detected in monitoring well MW-4 during the Phase I investigation.
MW-14S	Investigate ground water quality at the southern end of Site 02.

TABLE 5

SITE 02 - MELVILLE NORTH LANDFILL
SITE EMERGENCY CONTACTS

NETC Emergency Numbers:

Command Duty Officer	841-3456 or 3457
Security Office - Police	841-3241
NETC Fire Protection	841-3333
Public Works Trouble Desk	841-4001

Utilities:

Rhode Island Dig Safe	800-225-4977
NETC Dig Safe	841-2464

Newport Emergency Numbers:

Portsmouth Police Dept.	683-0300
Portsmouth Fire Dept.	683-1200
Newport Hospital	
General Number	846-6400
Emergency Room	846-6400 ext. 1120
Poison Control Center	277-5727

Additional Resources:

Dr. Erdil, or Dr. Stahl - TRC Company Physicians - Immediate Medical Care, Hartford, Connecticut - (203) 296-8330
Mr. James Peronto - TRC Project Manager - (203) 289-8631
Ms. Rachel Marino - NETC Environmental Coord. - (401) 841-3735
Mr. Robert Hanley - NETC Safety Officer - (401) 841-2478

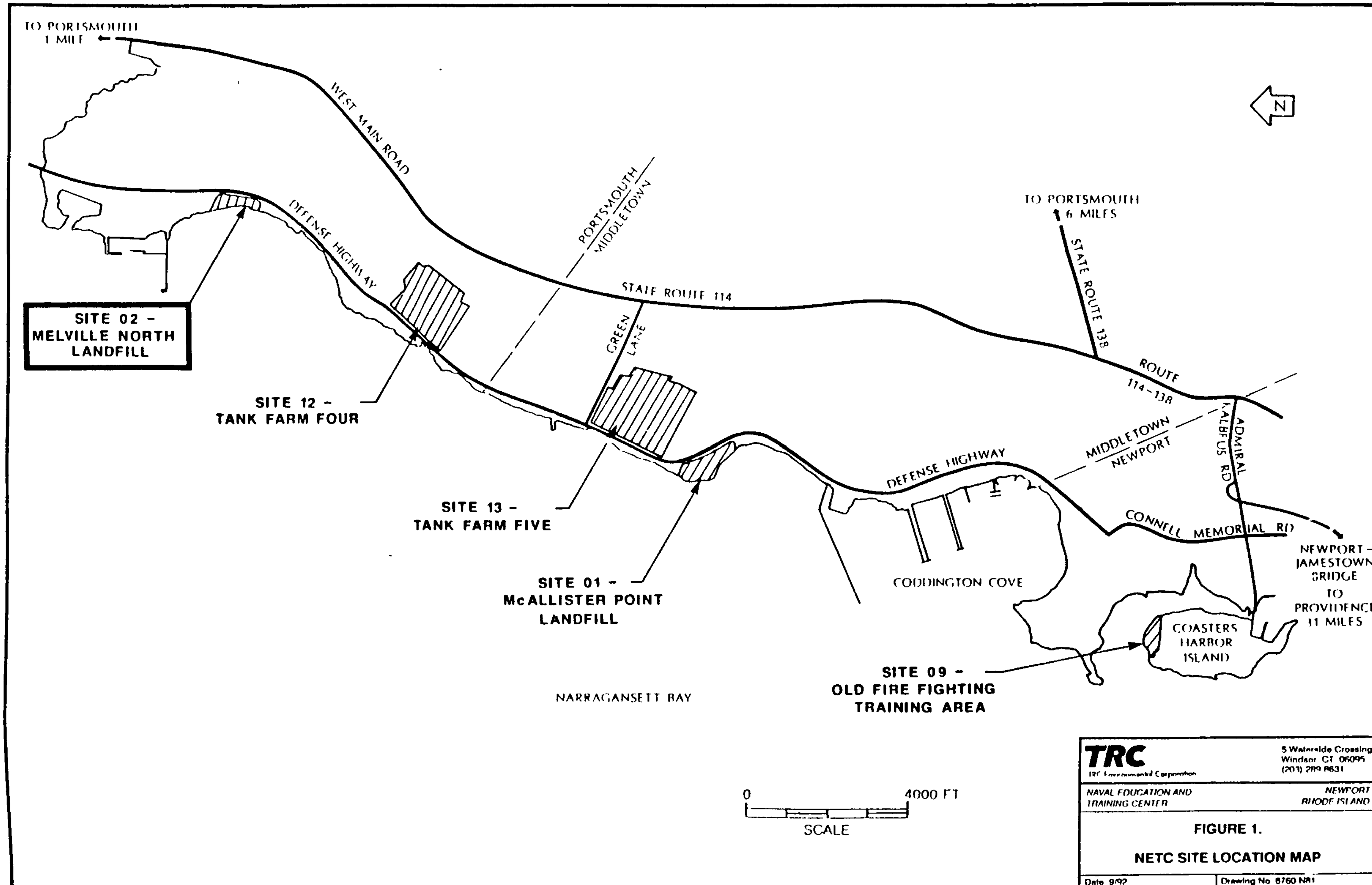
TABLE 6

SITE 02 - MELVILLE NORTH LANDFILL
PERSONNEL PROTECTION SUMMARY

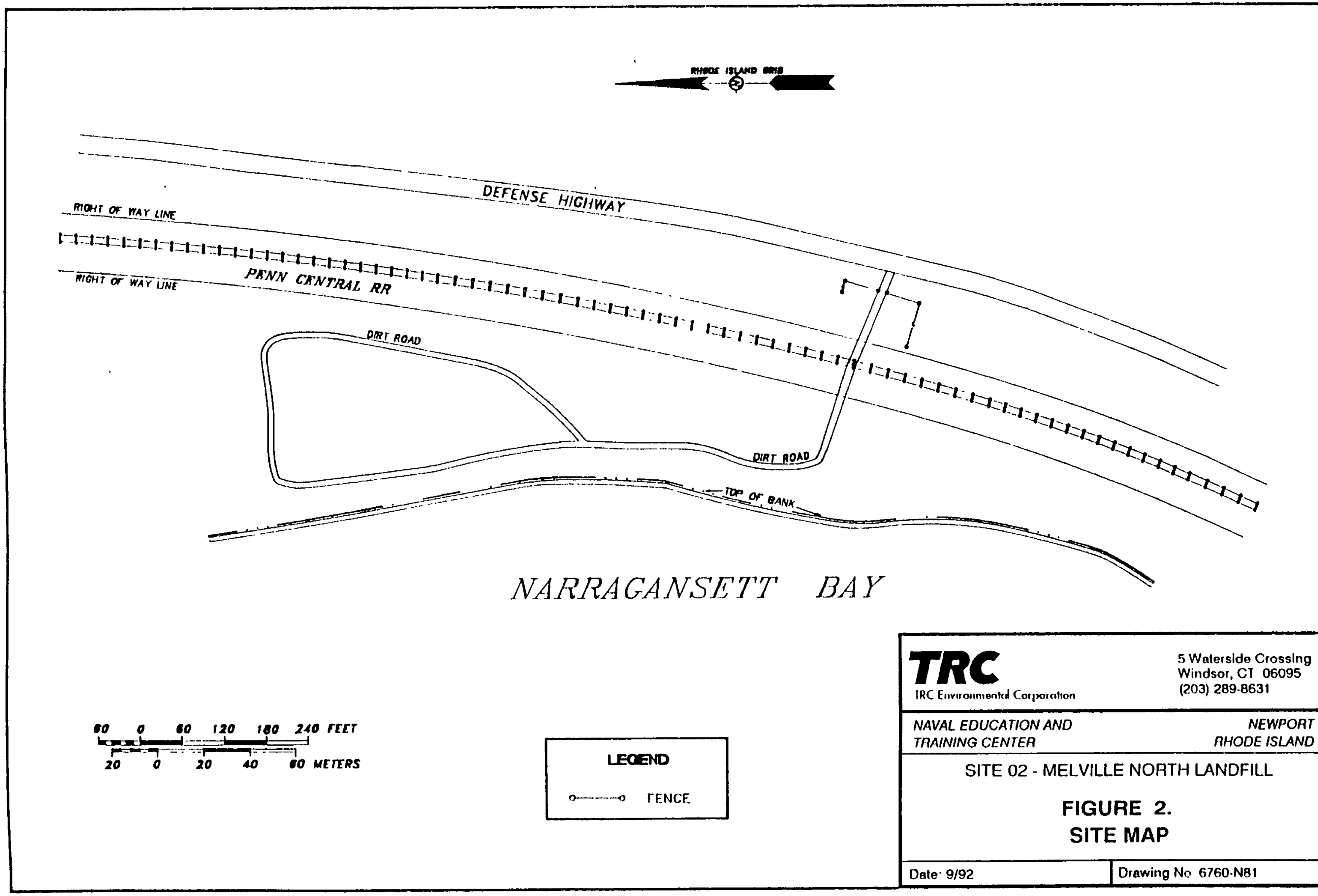
Activity	*Intitial Level of Protection*
Reconnaissance Survey	*D*
Geophysical Surveys	*D*
Soil Gas Survey	*Mod. D*
Surface Soil Sampling	*D*
Soil Boring	*Mod. D*
Ground Water Sampling	*Mod. D*
Land Survey	*D*

NOTE: *The personnel protection levels will be upgraded or downgraded as conditions warrant according to criteria specified in the project Health and Safety Plan (HASP).*

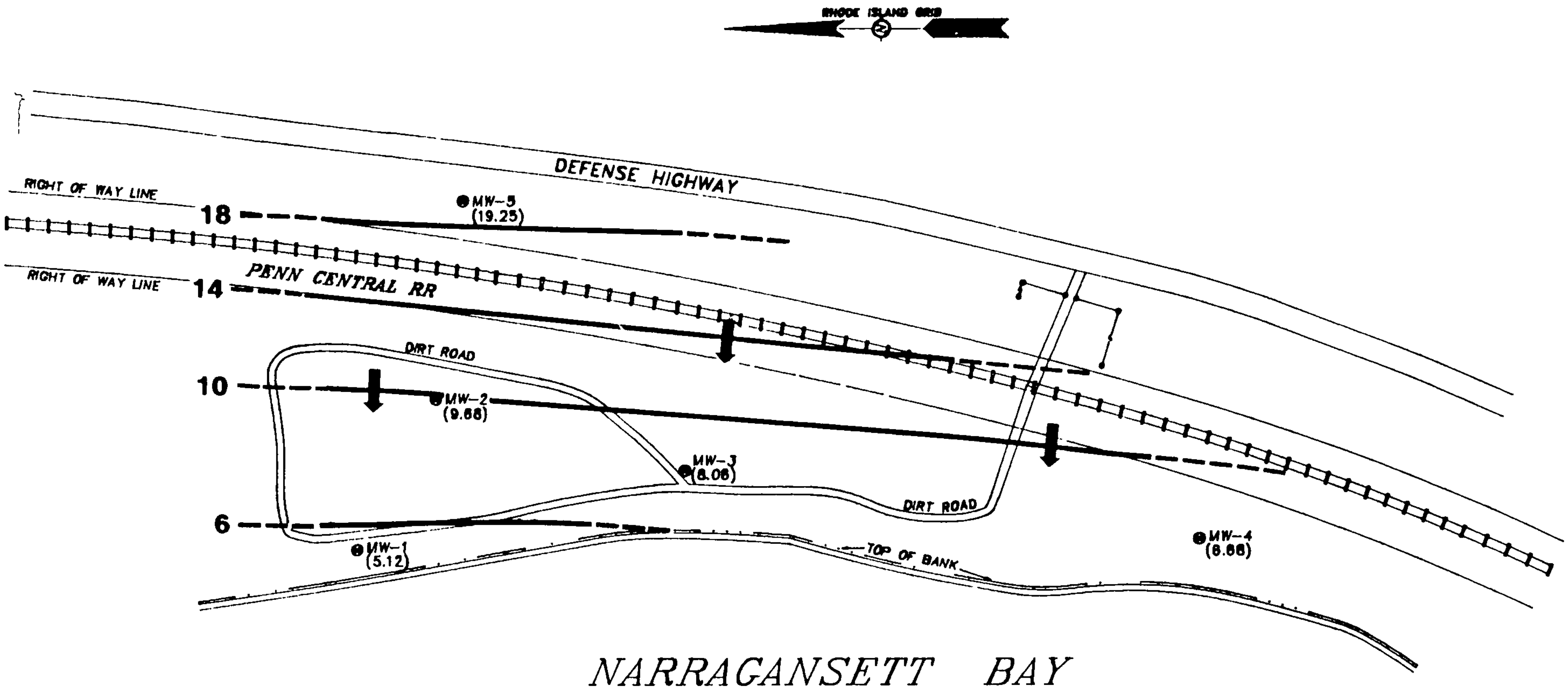
FIGURES

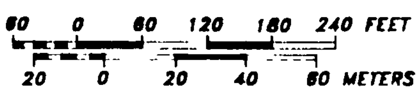


TO PORTSMOUTH 1 MILE
WEST MAIN ROAD
DEFENSE HIGHWAY
PORTSMOUTH
MIDDLETOWN
STATE ROUTE 114
GREEN LANE
TO PORTSMOUTH 6 MILES
STATE ROUTE 138
ROUTE 114-138
N
SITE 02 - MELVILLE NORTH LANDFILL
SITE 12 - TANK FARM FOUR
SITE 13 - TANK FARM FIVE
SITE 01 - McALLISTER POINT LANDFILL
SITE 09 - OLD FIRE FIGHTING TRAINING AREA
MIDDLETOWN
NEWPORT
KALBFUS RD
ADMIRAL
CONNELL MEMORIAL RD
NEWPORT - JAMESTOWN BRIDGE
TO PROVIDENCE 31 MILES
CODDINGTON COVE
COASTERS HARBOR ISLAND
NARRAGANSETT BAY
0
4000 FT
SCALE
TRC
5 Waterside Crossing
Windsor CT 06095
(203) 289 8631
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT RHODE ISLAND
FIGURE 1.
NETC SITE LOCATION MAP
Date 9/92
Drawing No 6760 N81



DEFENSE HIGHWAY
RIGHT OF WAY LINE
PENN CENTRAL RR
RIGHT OF WAY LINE
DIRT ROAD
DIRT ROAD
TOP OF BANK
NARRAGANSETT BAY
60 0 60 120 180 240 FEET
20 0 20 40 60 METERS
LEGEND
FENCE
TRC
TRC Environmental Corporation
5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT RHODE ISLAND
SITE 02 - MELVILLE NORTH LANDFILL
FIGURE 2.
SITE MAP
Date: 9/92
Drawing No 6760-N81





LEGEND

MW-3	MONITORING WELL LOCATION
(8.06)	GROUND WATER ELEVATION (feet above mlw)
6	GROUND WATER CONTOUR
	GROUND WATER FLOW DIRECTION

TRC
TRC Environmental Corporation
5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

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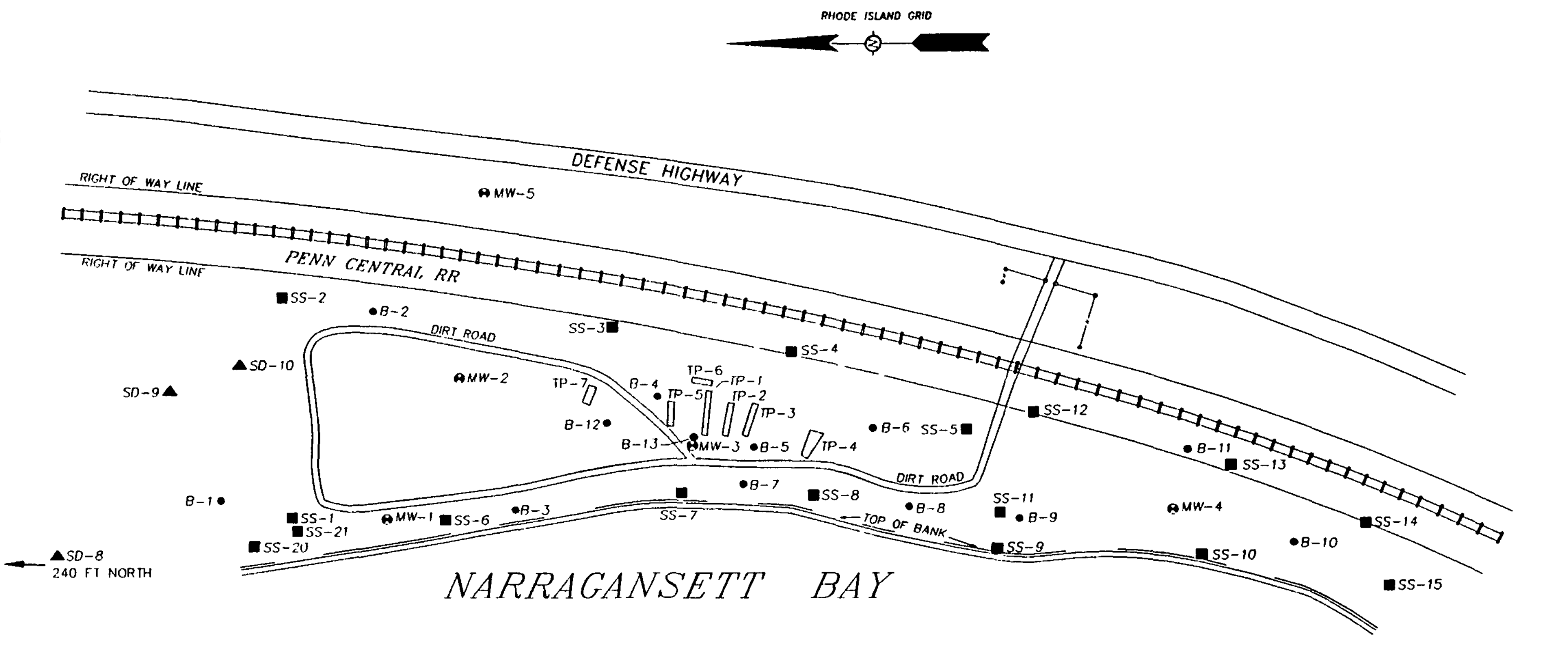
SITE 02 - MELVILLE NORTH LANDFILL

FIGURE 3.
GROUND WATER TABLE CONTOUR MAP

Date: 9/92 | Drawing No 6760-N81



60 0 60 120 180 240 FEET

20 0 20 40 60 METERS

LEGEND

SS-8 ■	SURFACE SOIL SAMPLE LOCATION
B-7 ●	BORING LOCATION
MW-4	MONITORING WELL LOCATION
SD-10 ▲	SEDIMENT SAMPLE LOCATION
TP-7	TEST PIT LOCATION

TRC

TRC Environmental Corporation

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

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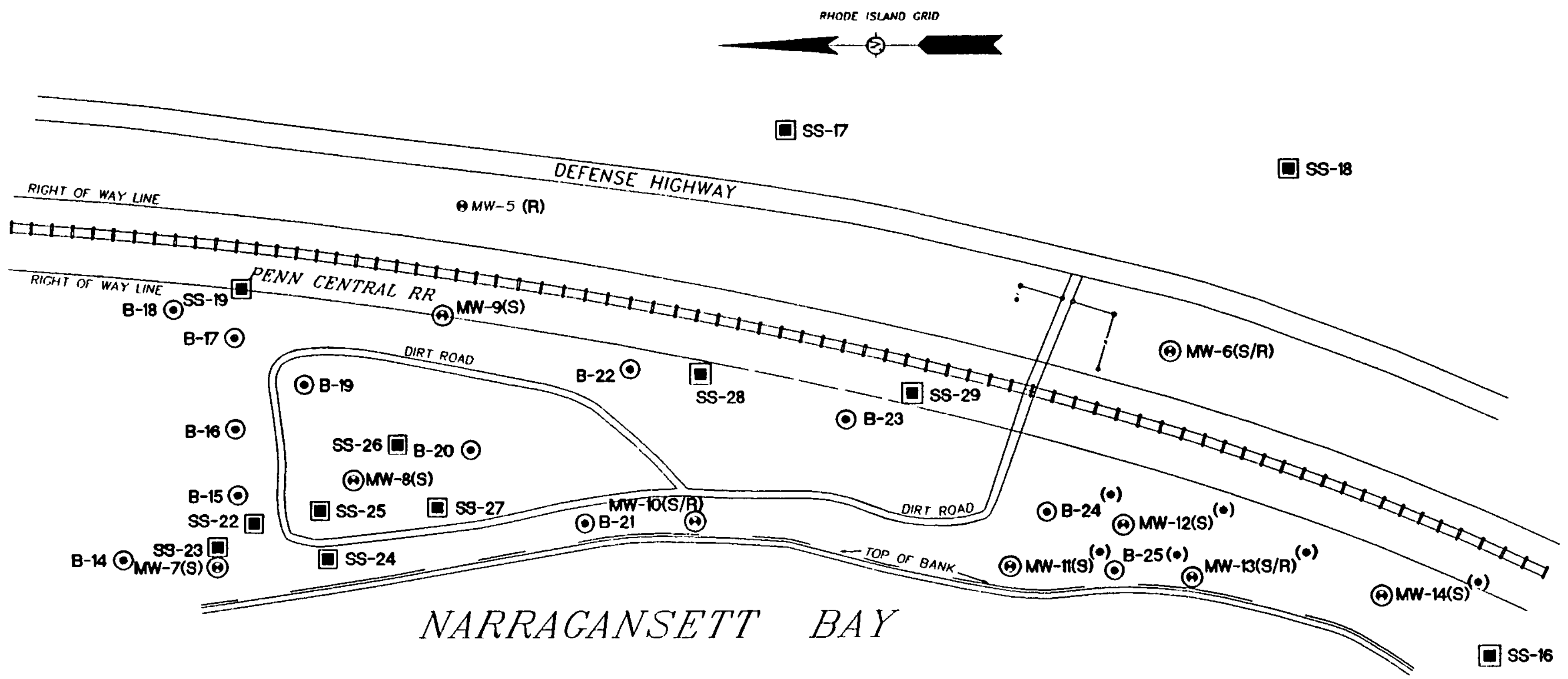
SITE 02 - MELVILLE NORTH LANDFILL

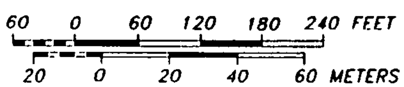
FIGURE 4.

PHASE I

INVESTIGATION SUMMARY MAP

Date 9/92 | Drawing No 6760-N81





LEGEND

SS-27 ■	SURFACE SOIL SAMPLE LOCATION
MW-11	MONITORING WELL LOCATION
B-20 ⊙	BORING LOCATION
(S)	NEW SHALLOW WELL
(R)	NEW BEDROCK WELL
(•)	LOCATIONS BASED UPON SOIL GAS FINDINGS

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FIGURE 5.
PHASE II
INVESTIGATION SUMMARY

Date 9/92 | Drawing No 6760-N81

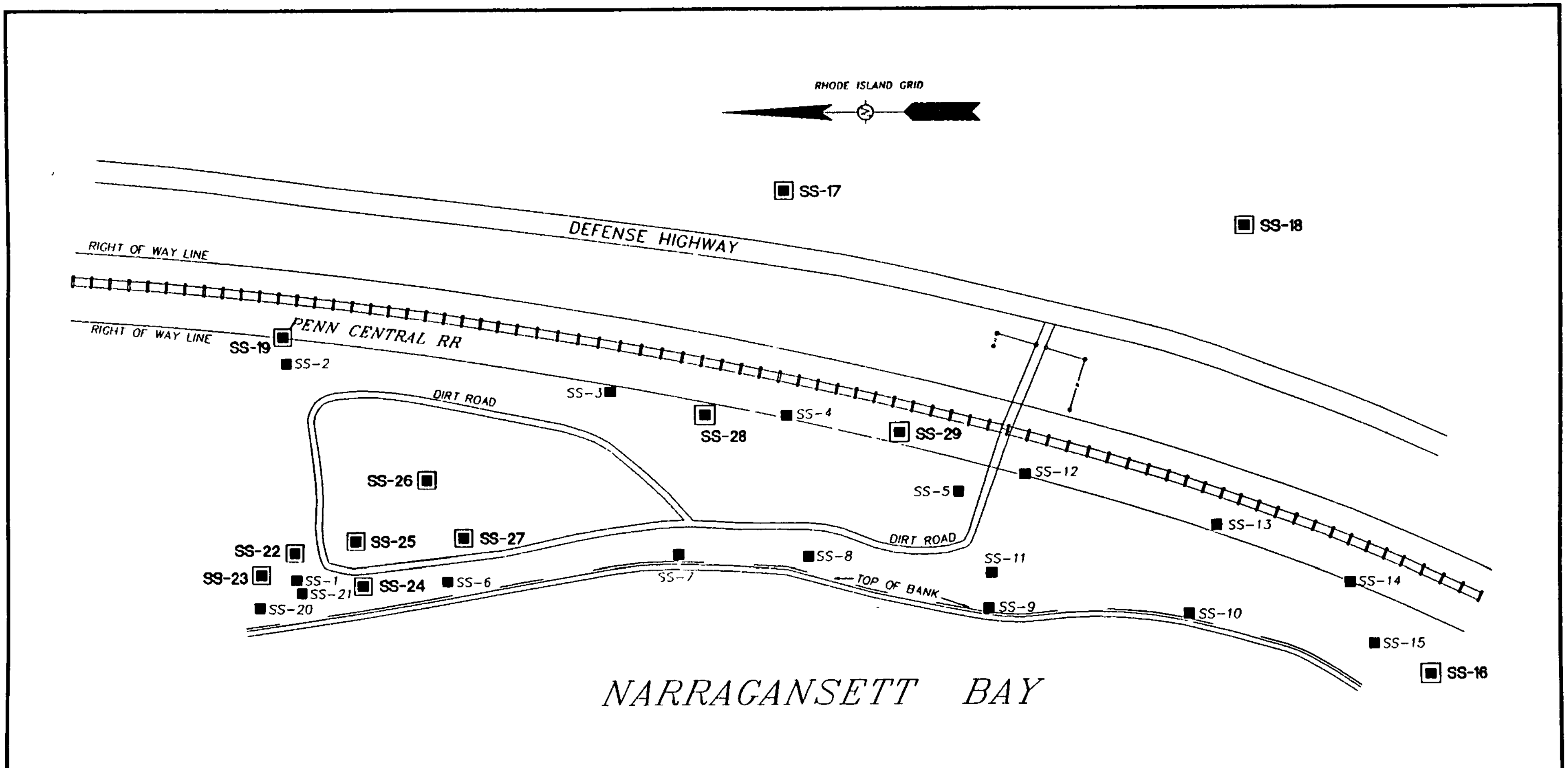

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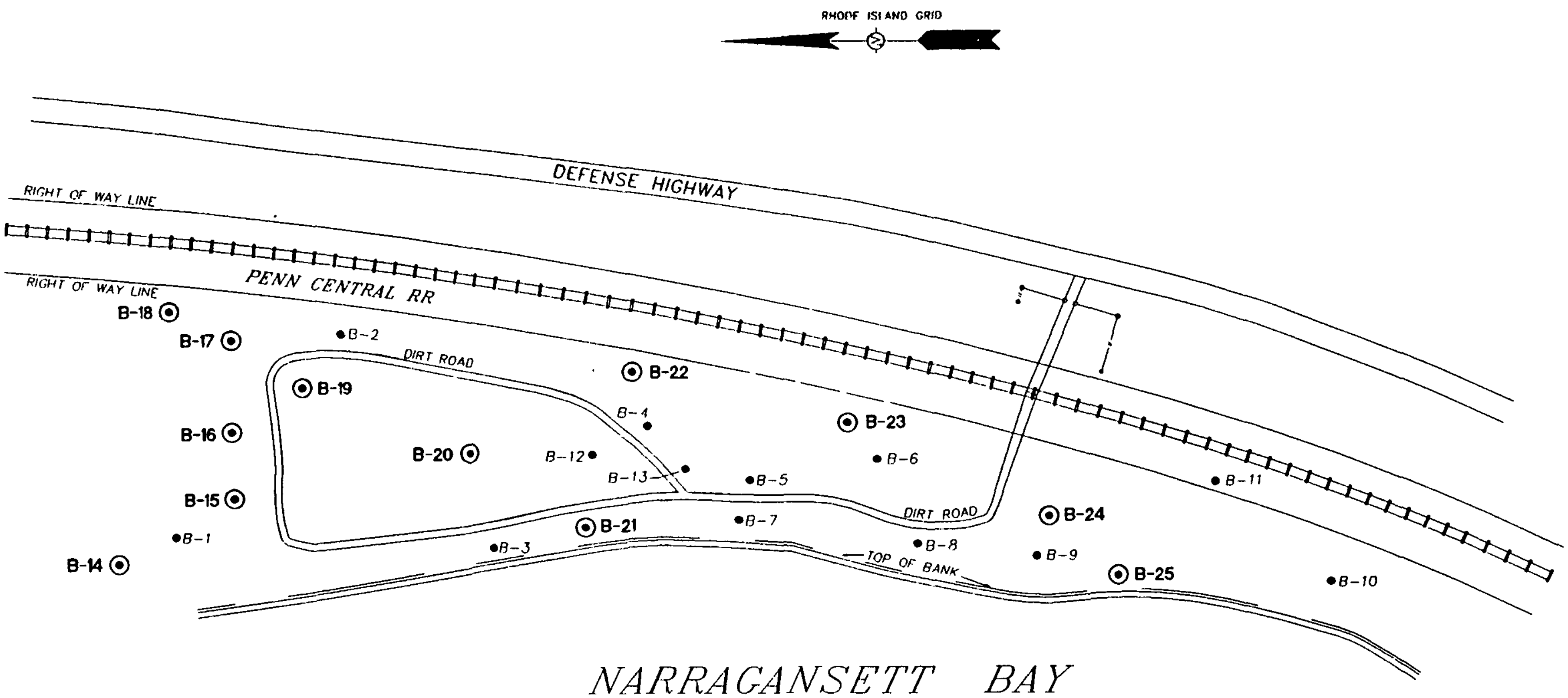
FIGURE 6.

SURFACE SOIL SAMPLE LOCATIONS

Date 9/92 | Drawing No 6760-N81



60 0 60 120 180 240 FEET
20 0 20 40 60 METERS

LEGEND

B-7 • BORING LOCATION (PHASE I)

B-20 ⊙ BORING LOCATION (PHASE II)

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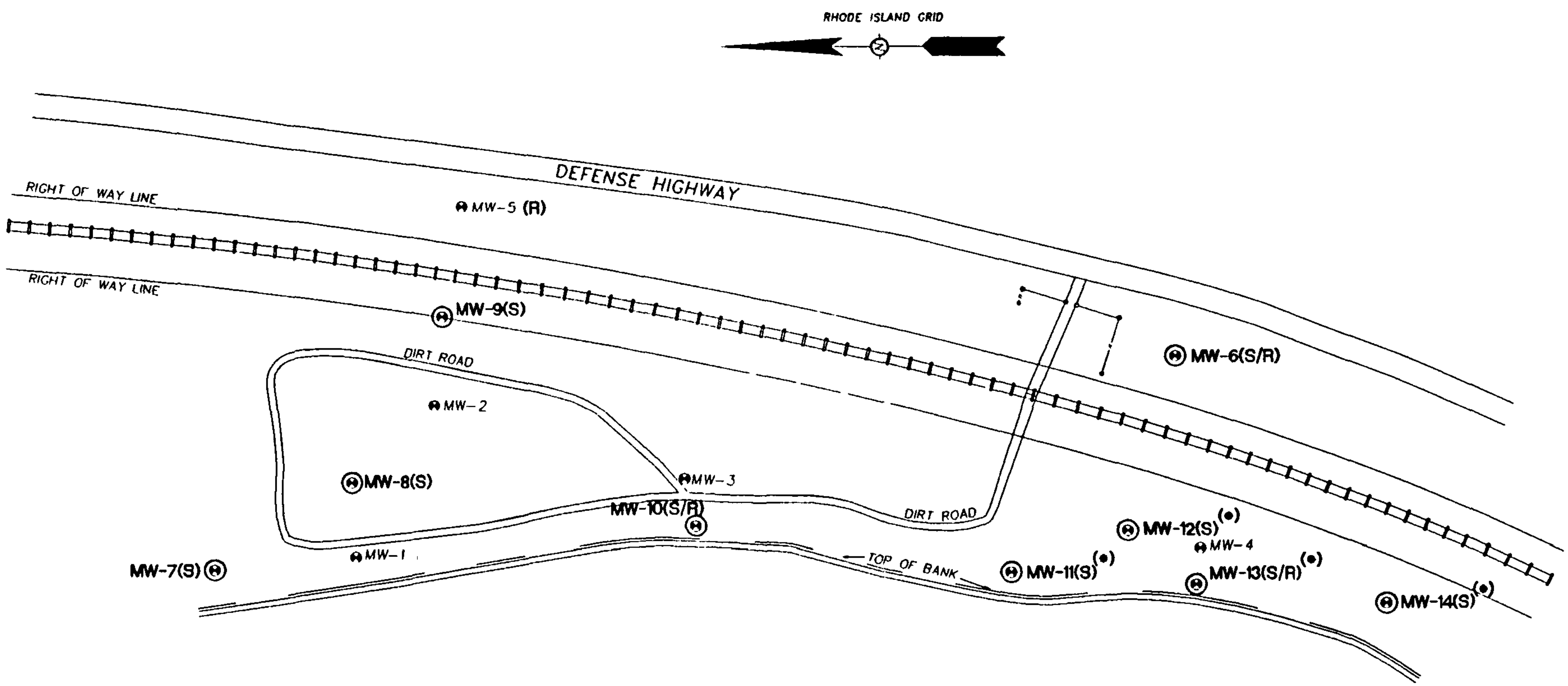
FIGURE 7.

TEST BORING LOCATIONS

Date 9/92 | Drawing No. 6760-N81



60 0 60 120 180 240 FEET

20 0 20 40 60 METERS

LEGEND

MW-3	MONITORING WELL LOCATION (PHASE I)
MW-11	MONITORING WELL LOCATION (PHASE II)
(S)	NEW SHALLOW WELL
(R)	NEW BEDROCK WELL

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FIGURE 8.
MONITORING WELL LOCATIONS

Date. 9/92 | Drawing No. 6760-N81

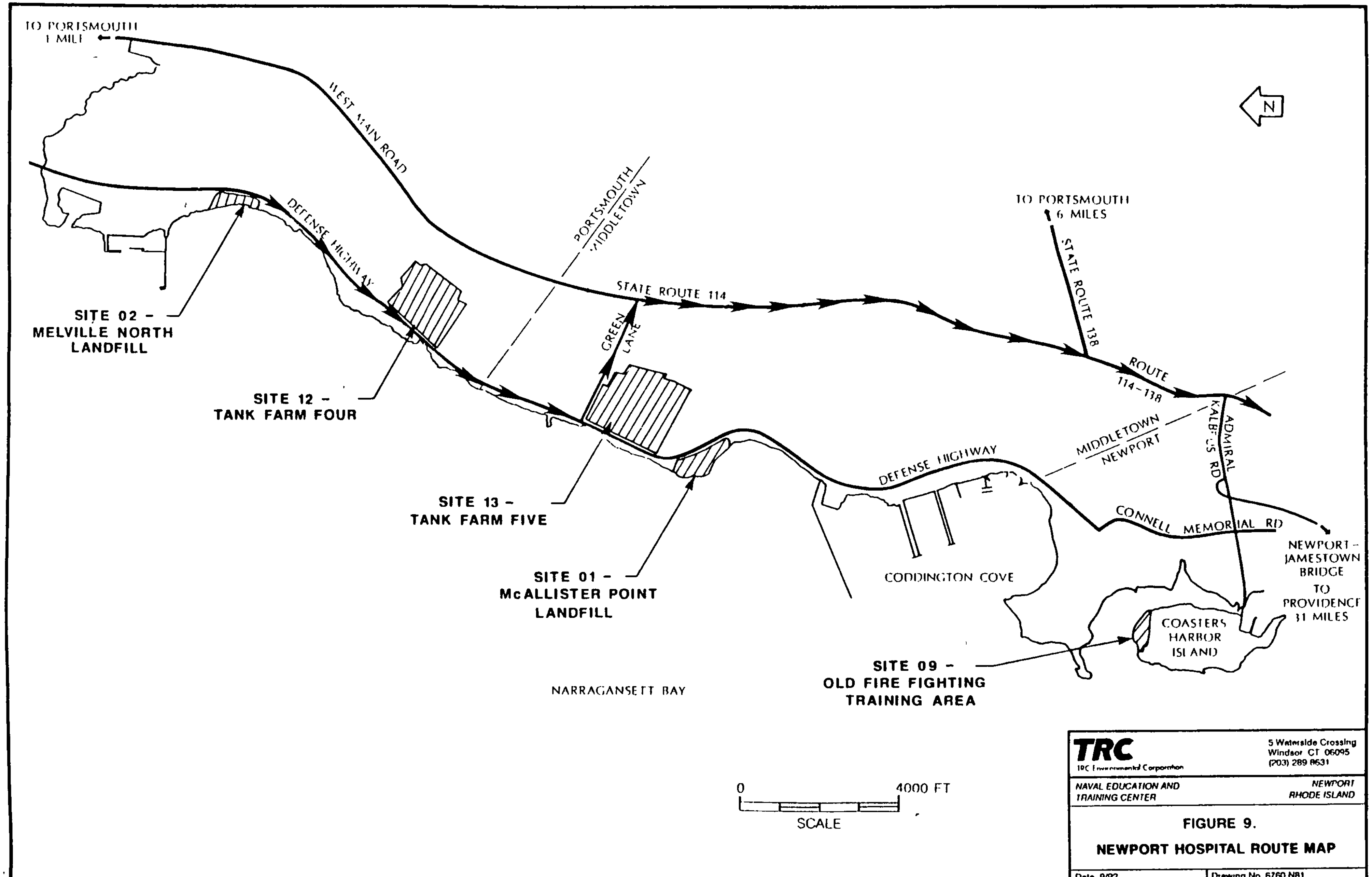
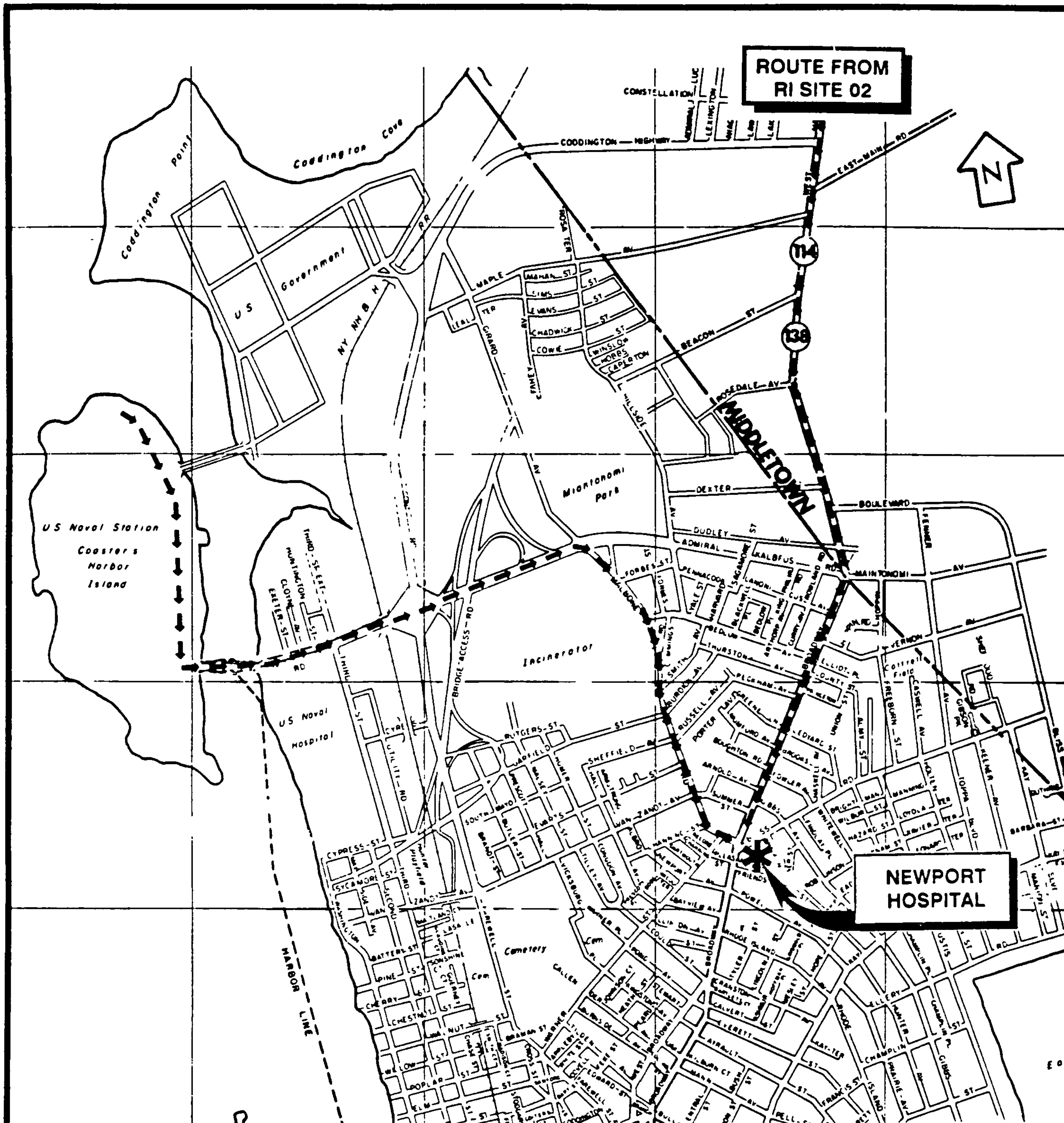


FIGURE 9.

NEWPORT HOSPITAL ROUTE MAP



0 1/4 1/2

SCALE IN MILES

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FIGURE 9A.

NEWPORT HOSPITAL ROUTE MAP

Date 9/92

Drawing No 6760-N81

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INSTALLATION RESTORATION PROGRAM

VOLUME III - APPENDICES
FIELD SAMPLING PLAN

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

APPENDIX A
REGULATORY INFORMATIONS

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September, 1992

TRC-EC Project No. 6760-N81-110
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APPENDIX A
REGULATORY INFORMATION

- *RIDEM Ground Water Regulations*
- *RIDEM Surface Water Quality Regulations*

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

APPENDIX B
FIELD SAMPLING METHODOLOGY PLAN

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER,
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Consultants, Inc.
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Philadelphia, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

TABLE OF CONTENTS

1.0 AMBIENT SURVEYS

Ambient surveys provide a means of measuring concentrations of volatile organic compounds, and combustible gases and oxygen during all Phase II field investigation activities. Data produced from ambient surveys provide "real time" data from which field personnel may monitor site hazards, and act accordingly.

The following two ambient survey techniques will be used throughout the course of investigations at each site.

- Volatile Organic Compound Survey
  Combustible Gas and Oxygen Survey

1.1 VOLATILE ORGANIC COMPOUND SURVEY

An ambient air monitoring program will be conducted at the site prior to and during field investigation activities. An OVA Flame Ionization detector (FID) (Century Organic Vapor Analyzer OVA 128, or equivalent) and a photoionization detector (PID) (HNu Model PI-101 Photoanalyzer with 10.2 eV lamp, or equivalent) will be used to survey the site area prior to sampling activities to assess individual site background conditions. During the site sampling activities these instruments will also be used to continuously monitor ambient and sample concentrations of volatile organic vapors.

Since instruments preforming measurements have inherent limitations arising from equipment limitations (fluctuations or drift) and changes in ambient conditions, instrument adjustments may be required to maintain their calibration. Calibration checks of the HNu and OVA will be preformed a minimum of twice per day (at the beginning and end of each day). The OVA and HNu will be calibrated with a hydrocarbon-free "zero" gas and a known hydrocarbon concentration. The OVA and HNu calibration gases consist of concentrations of 10 ppm methane in air and approximately 54 ppm isobutylene in air, respectively. Changes in instrument settings will be noted in the field notebooks under instrument calibration.

1.2 COMBUSTIBLE GAS AND OXYGEN SURVEY

Prior to initiating site activities, the site will be screened for combustible gases and oxygen with a combination combustible gas (lower explosive limit - LEL) and oxygen (O_2) meter. During subsurface explorations, or in any confined spaces, an LEL/O_2 meter will also be used continuously to measure for combustible gases and oxygen. The LEL/O_2 meter will be calibrated a minimum of twice per day (start and finish) with a pentane gas/oxygen mixture.

2.0 GEOPHYSICAL SURVEYS

The geophysical surveys are being used to aid in determining subsurface conditions (e.g., fill/waste areas, bedrock topography) at the site. The findings of the geophysical surveys may be used to "fine tune" planned soil boring and/or monitoring well locations. Significant deviations from this plan as a result of the geophysical survey findings will be discussed with representatives of the Navy, EPA, and RIDEM prior to implementation of such modifications.

The seismic refraction geophysical survey technique will be used in the planned investigation of the site. Below is a discussion of the technique.

2.1 SEISMIC REFRACTION SURVEY

A seismic refraction survey is a means of determining the depths to a refracting horizon and the thickness of major seismic discontinuities overlying the high-velocity refracting horizon. The seismic velocities measured by this technique can be used to calculate the mechanical properties of subsurface materials (moduli values), as well as for material identification and stratigraphic correlation.

Interpretations are made from travel time curves showing the measurement of the time required for a compressional seismic wave to travel from the source ("shot") point to each group of vibration sensitive devices (seismometers or geophones). The geophones are located at known intervals along the ground surface. Various seismic sources may be used, including a drop weight, an air gun, and small explosive charges.

The elastic wave measured in the seismic refraction method, the "P" or compressional wave, is the first arrival of energy from the source at the detector. This elastic wave travels from the energy source in a path causing adjacent solid particles to oscillate in the direction of wave propagation. An example of how seismic refraction will determine type material and depth is presented below. The example site has an upper layer composed of a lower velocity material than the bottom layer (i.e., bedrock). At smaller distances between source and detector the first arriving waves will be direct waves that travel near the ground surface through the lower velocity material. At greater distance, the first arrival at the detector will be a refracted wave that has taken an indirect path through two layers. The refracted wave will arrive before the direct wave at a greater distance along the spread because the time gained in travel through the higher-speed material compensates for the longer path. Depth computations are based on the ratio of the layer velocities and the horizontal distance from the energy source to the point at which the refracted wave overtakes the direct wave.

The specifications for the seismic refraction survey at the site will be determined during pre-investigation site visit with geophysical subcontractors.

3.0 SOIL GAS SURVEY

In general, soil gas sampling will be used at the site to aid in defining the presence, nature, and/or extent of subsurface volatile organic compound (VOC) contamination. Increased concentrations of gaseous VOCs are commonly present within pore spaces of VOC contaminated unsaturated soils, above contaminated buried wastes, and above contaminant plumes of ground water. Analysis of soil gas is an effective screening method to assess the presence and extent of an area contaminated with VOCs. The soil gas survey information is intended to aid in directing surface and subsurface investigation activities at the site.

The findings of the soil gas surveys may be used to "fine tune" planned sampling locations. Significant deviations from this plan as a result of the soil gas survey findings will be discussed with representatives of the Navy, EPA, and RIDEM prior to implementation of any such modifications.

3.1 SAMPLING STRATEGY AND SAMPLE LOCATION

A sample grid may be established in the site Field Sampling Plans to initially characterize appropriate areas in a systematic manner. Additionally, a set number of biased survey points may be established at a site in areas of concern. During the soil gas survey, the sampling grid will be extended, within Navy controlled property, to sufficiently define areas of detected volatile organic contamination. Sampling points may be added to provide further definition, as judged necessary by the TRC-EC field team leader. Any areas of staining or vegetative stress will be noted in the soil gas field notebook and located on a site map.

3.2 SOIL GAS SAMPLING METHODS

All soil gas points will be sampled by a truck mounted-hydraulic sampling device (e.g., geoprobe). Interconnectable lengths of 1" diameter steel pipe will be advanced by the hydraulic sampling device to the required sampling depth. The sampling depths will be determined by evaluating the depth to water, potential contamination sources, and overburden material. Upon reaching the required sample depth, the bottom of the steel pipe will be opened and a small diameter stainless steel probe attached to teflon tubing will be lowered through the steel casing to the bottom of the hole. Packing material or an inflatable packer will be located just above the perforations at the base of the probe. This will isolate the sampling zone from the steel pipe annulus. Each soil gas sample will be collected from the prescribed depth through the probe after a pump has extracted three apparatus air volumes from the probe. The soil gas sample will then be extracted from the air mass by inserting a glass gas tight syringe into the polyethylene tubing which connects the probe to the vacuum pump. The syringe will extract up to 1 ml of air, the exact volume extracted depends on the concentration of volatile organics in the sample. The sample will then be submitted to a climate-controlled mobile laboratory for "real time" analytical results. Soil gas samples will be analyzed on a gas chromatograph equipped with a flame-ionization detector (FID). All soil gas samples will be screened for petroleum products using modified (for soil gas) EPA 602 procedures. Soil gas samples will also be run simultaneously through an electron capture detector (ECD) for chlorinated compounds typically contained in industrial solvents, following modified (for soil gas) EPA 601 procedures. Between all sample injections (including unknowns) the syringe will be heated to 60°C and flushed with UPC grade nitrogen. Standards will be analyzed in order to quantify the following compounds (to a reporting limit of 1.0 ug/l). A total FID volatiles compound concentration will also be calculated for each soil gas sample run.

The laboratory-grade gas chromatograph (GC) will be calilibrated prior to the initiation of field work each day. Calibration curves for the GC will include at least three points, on which a linear regression will be run to determine the detector response curve. Analyte standards will be analyzed at intervals of every 10 soil gas samples during analysis. Check standards will also be run at the end of each day to gauge the calibration status. The GC will not analyze any samples if the correlation coefficients of any standardized compounds are less than 0.99.

Field blank samples are collected by drawing prepurified nitrogen or ambient air (filtered through an MSA organic cartridge filter) through the sampling apparatus and probes prior to each days sampling activities, after every twentieth sample, and at the conclusion of each day. Field blank samples are labeled and analyzed in the same manner as the actual field samples and are visually indistinguishable from the actual field samples (i.e., blind to analyst).

Prior to each days work the soil gas steel pipe will be washed with a non-phosphate detergent/distilled water solution, and wiped dry with clean paper towels. The pipe will then be rinsed with distilled water and wiped dry with clean paper towels. The sampling probe will be washed externally with detergent/distilled water and scrubbed with clean paper towels. The exterior of the probe will be rinsed with distilled water and wiped with clean paper towels. The interior of the probe will be flushed with detergent/distilled water and purged for approximately 30 seconds with 20 psi of ultra-zero grade air, prepurified nitrogen, or filtered ambient air.

3.3 SAMPLE DESIGNATION AND ANALYSES

For each soil gas sample collected, the soil gas grid number, depth, and the ambient air temperature (at the time of collection) will be recorded in the field log book.

3.0 SURFACE SOIL SAMPLING

The objectives of the surface soil sampling are to assess the presence and nature of surface soil contamination at the site. This information will aid in meeting overall sampling plan objectives. Site area specific background surface soil samples will be collected.

4.1 SAMPLING STRATEGY AND SAMPLE LOCATION

Surface soil sampling and other sampling activities have previously been conducted at the site. When appropriate, the findings and results of previous investigations were used in establishing the surface soil sampling strategy at the site. Surface soil samples will be collected and analyzed as discrete samples.

4.2 SURFACE SOIL SAMPLING METHODS

Surface soil samples will be collected directly with a stainless steel spoon. In some instances (e.g., dense soil) a stainless steel, hand bucket auger may be used to assist in the collection of the samples. Soil samples to be analyzed for VOCs will be collected from a depth of at least six inches below the ground surface. These samples will be transferred directly to the sample container to minimize loss of VOCs from the sample. Other surface soil samples will be collected directly from the ground surface (0-3 inches), below any surface vegetation (leaves, grass, etc.) with a dedicated stainless-steel spoon. All but the sample portion for VOC analysis will be homogenized in a stainless steel bowl prior to being placed into appropriate containers.

Stainless steel spoons and bowls will be dedicated to each sample and will be laboratory decontaminated. Other sampling devices (hand augers) will be decontaminated prior to each use in the field. A geologic and general description (e.g. stains, odors) of each surface soil sample collected will be recorded in a field notebook.

4.3 SURFACE SOIL SAMPLE DESIGNATION

Surface soil samples will be assigned a designated field identification number which will reference the RI site number, sample type, sample location, and sampling date. Below is an example of a surface soil sample identification number:

Example: MN-SS2-032093

where:
MN = Melville North Landfill
SS = Surface Soil Sample
2 = Sample Location Number
032093 = Sampling Date (March 20, 1993)

5.0 TEST BORINGS

Subsurface test borings will be conducted to aid in assessing the presence and nature of soil contamination at the site. Information obtained from the geophysical and soil gas surveys may be used to "fine tune" planned test boring locations at the site. Information obtained from the test boring activities may in turn, be used to "fine tune" any planned monitoring well locations. In instances where test boring findings indicate an ideal location for a well (e.g., high levels of contamination observed in fill or aquifer), the test boring may be used for installation of a ground water monitoring well. The rationale for any deviations to the Field Sampling Plans, based upon such field observation, will be discussed with representatives of the Navy, EPA, and RIDEM prior to implementation of such modifications.

5.1 SAMPLING STRATEGY AND LOCATION

Test borings will be drilled and sampled to aid in assessing subsurface soil characteristics and the nature of soil contamination at the site. When appropriate, site background information and the findings and results of previous investigations were used in establishing the test boring plan.

5.2 SUBSURFACE SOIL BORING AND SAMPLING METHODS

Split spoon soil samples will be collected at 2.0-foot intervals from each borehole. Standard penetration tests [ASTM D1586-84 (1984)] will be conducted for every 2.0-foot sampling interval. The physical characteristics of each soil sample will be geologically logged and generally described in a field notebook. General observations which may be described include staining, odors, fill material, and wastes. Soil samples to be submitted for laboratory analyses will be transferred from the split spoon to the sample container with a dedicated stainless-steel spoon. Sampling equipment (e.g., augers, drilling rods, spoons) will be decontaminated prior to each use as described in the project Quality Assurance/Quality Control Plan. Split spoon soil samples will be monitored for the presence of total VOC vapors with a flame or photo-ionization detector. Field observations will be recorded in a field notebook.

At boring locations open to the public, test borings will be backfilled to within 1.0 foot of the ground surface, after which a cement-bentonite grout will be used to "top-off" the hole to mininimize potential future human exposure to contaminated drill cuttings. Remaining drill cuttings will be handled as described in the Investigation Derived Waste Plan in Appendix E of this Work Plan.

5.3 TEST BORING SAMPLE DESIGNATION

Test boring samples submitted for laboratory analyses will be assigned a designated field identification number which will reference the RI site number, sample type, sample location, sample number, and sampling date. Below is an example of a test boring soil sample identification number:

Example: MN-B42-041293

where:
MN = Melville North Landfill
B4 = Test Boring Location Number
2 = Second Sample Interval
041293 = Sampling Date (April 12, 1993)

6.0 MONITORING WELLS

Monitoring wells will be installed to aid in assessing the nature and extent of any ground water contamination. The monitoring wells will also be used to provide hydrogeologic information on the aquifer characteristics. Four separate discussions on the monitoring well investigations are presented below concerning the following: well sampling strategy, well construction details, well sampling methods, and the well sample designation plan.

6.1 MONITORING WELL LOCATIONS

Information obtained from initial Phase II RI field activities (e.g., test borings, soil gas sampling, geophysical surveys) may be used to "fine tune" the final well locations at the site, as justified by the information.

6.2 WELL BORING, DRILLING AND SAMPLING METHODS

The boreholes for overburden wells will be advanced using 4¼-inch minimum inside diameter (I.D.) hollow-stem augers. Split spoon samples will be collected continuously at 2.0-foot intervals from the well borings until the water table has been reached or split-spoon refusal (encountered boulders or bedrock). After the water table has been been encountered split-spoon soil samples will be collected at 5-foot intervals or an identifiable change in strata. The split-spoons will be advanced according to the standard penetration test method [ASTM 1586-84 (1984)]. The standard penetration test defines split-spoon refusal as less than six inches of penetration for 100 blows with a 140 pound hammer falling 30 inches in conformance with ASTM 1586-84. The physical characteristics of each soil sample will be visually characterized and geologically described in a field notebook. Split spoon samples will also be monitored with a flame or photo-ionization detector (OVA or HNu). Observations will be recorded in the field notebook.

Soil samples to be submitted for laboratory analyses will be transferred directly from the split spoon to the sample container with a dedicated decontaminated stainless-steel spoon. Sampling equipment (e.g., augers, drilling rods, split-spoons) will be decontaminated prior to each use.

At locations where sampler or auger refusal is encountered prior to the water table, a bedrock core will be collected to characterize the bedrock. The monitoring well borehole will be advanced ten feet into the bedrock with two 5-foot, double-tube, Nx rock core barrels. Once the cores are retrieved and opened, a description of the bedrock will be recorded in a field notebook. The rock core will be kept and stored in a core box for future reference. Prior to construction of the overburden monitoring well, the open borehole in the bedrock will be backfilled with a bentonite slurry to the top of the bedrock surface and allowed to set overnight.

The final depth of monitoring wells will be assessed by TRC-EC field personnel. Variables to be considered in establishing the final well depth will include material encountered, observed contamination, geologic material, depth to the water table, and site sampling objectives.

Well boring drill cuttings will be handled in accordance with the Investigation Derived Waste Plan described in Appendix E of this Work Plan.

6.3 WELL CONSTRUCTION

Drilling and well construction activities will be subcontracted to a qualified well drilling firm. On-site drilling activities will be conducted under the supervision of a TRC-EC geologist/engineer.

Monitoring well construction specifications for this project include the following:

- Six inch borehole (minimum);
- Two-inch inside diameter PVC riser and screen;
- Threaded or press joints only on PVC pipe (no glued joints);
- Silica (quartz) sand backfill to two foot above the screened interval;
- Two foot minimum thick bentonite seal above the sand pack;
- Portland cement/bentonite slurry (about 6:1 ratio respectively) in the well annulus from the top of the bentonite seal to the surface;
- All casing sealant and drilling fluids will be mixed with potable water;
- Vented well cap; and
- Steel casing with a locking cap will be securely set in cement over the well casing stick up and a minimum of three feet below the ground surface. Wells will be clearly numbered on casing. In paved areas, and high traffic areas, wells will be installed with curb boxes constructed at or slightly below grade.

Well screen and riser lengths may vary for each well. Screen lengths for wells intercepting the water table will be a maximum of ten feet, with no more than five feet extending above the water table. The five-foot length of screen above the water table is intended to maintain the water table within the screened interval during seasonal and/or diurnal ground water fluctuations. A ten-foot screen length will be used for deep wells installed below the water table. Well riser lengths will be field-determined so the top of the casing extends approximately one to two feet above the ground surface for wells with stick-up protective casing and approximately four to six inches below grade for wells with flush-mounted curb boxes. The driller and TRC-EC geologist/engineer will maintain accurate written logs of the well construction details.

6.4 WELL DEVELOPMENT

Wells will be developed by the surge block and pump technique. Fine-grained material around the well screen will be drawn into the well and removed by agitating the well water with a surge block and simultaneously pumping water from the well at a low discharge rate. A centrifugal pump outfitted with ASTM drinking water grade polyethylene tubing will be used for removing the water from the well. To prevent cross-contamination between the wells, the surge block will be decontaminated between each well. The surge block will be decontaminated with non-phosphate detergent and tap water, rinsed with tap water, rinsed with methanol, air dried, and rinsed with deionized water. The polyethylene tubing will also be replaced between each well. The dedicated new tubing will be rinsed with deionized water prior to its use. Water produced during well development will be drummed for characterization and analysis.

Should the depth of the well or to ground water prohibit the use of the surge block and pumping technique, an alternative method will be used to develop the well. A suitable pumping device (e.g., submersible pump, Waterra™ hand pump) will instead be placed in the well and used for development. Equipment inserted into the well for development will either be dedicated to that well, or, at a minimum, washed with non-phosphate detergent and tap water, and rinsed with tap water and then deionized water prior to each use.

The volume of ground water extracted from each monitoring well during development will be determined by continually monitoring the following parameters: pH, temperature, specific conductance, and turbidity. Development will continue until pH, temperature, and specific conductance have all stabilized and turbidity is $\leq$ 10 NTU's or has stabilized to $\pm$ 10% on successive well volumes.

6.5 GROUND WATER SAMPLING METHODS

A period of at least two weeks will elapse between well development and ground water sampling. Prior to the initiation of sampling activities, the water level of each monitoring well will be measured to the nearest 0.01 ft with an electronic water sensing device (Solinist Model 101) and recorded in a field notebook. The water level indicator will be decontaminated with deionized water prior to each use unless visual observations (e.g., oil, odors) indicate additional decontamination is necessary. Additionally, at those locations where the presence of a non-aqueous phase liquid (NAPL) is anticipated due to previous site information or as potentially indicated by test or monitoring well boring observations, the presence of NAPLs will be assessed (e.g., the thickness of the NAPL will be determined) prior to sampling with an oil/water interface probe. At a minimum, the interface probe will be decontaminated with non-phosphate detergent, tap water, methanol, hexane, tap water and then deionized water after each use.

Prior to ground water sampling, a minimum of three well volumes will be purged from each well using either a hand-operated bailer, a peristaltic pump (preferred), a centrifugal pump, or a submersible pump. The ground water extracted during purging will be continually monitored for pH, temperature, specific conductance, and turbidity. Ground water will be purged until the pH, temperature, and specific conductance have all stabilized and turbidity has stabilized to $\pm$ 10% on successive well volumes. Purging rates will be kept below three gallons/minute to avoid over-pumping or pumping the well to dryness. In addition, the well will be purged from the top of the water column down to allow the purging of the entire water column. The well will be sampled within two hours of purging.

Ground water samples will be collected with dedicated/decontaminated teflon bailers. A teflon leader-line approximately 3-feet in length will be attached to the end of the bailer. A polyethylene coated nylon rope will then be attached to the teflon line and used to lower and raise the bailer in the monitoring well. The ground water sample will be collected by slowly lowering the bailer into the well until the bailer is filled with water. Once filled, the bailer will be raised to the surface where the ground water will be transferred to the appropriate sample containers. The order of sample bottle filling is as follows: TCL VOC (immediately upon completion of purging the well), TCL BNA, TCL pesticides/PCBs, and TAL metals, cyanide, and TOC. The teflon bailers will be laboratory-decontaminated prior to use.

The pH, specific conductance, temperature, dissolved oxygen, salinity, and redox potential of the ground water will be measured in the field immediately after sample collection. The pH, temperature, and redox potential will be measured using an Orion Model SA 230 meter, or equivalent. Specific conductance and salinity will be measured with a YSI Model 33 SCT meter, or equivalent. Dissolved oxygen will be measured with a YSI Model 51B Oxygen meter, or equivalent. Field measurements will be recorded in a field notebook.

6.6 WELL SAMPLE DESIGNATION

Ground water and well boring soil samples will be assigned a designated field identification number which will reference the RI site number, sample type, sample location number, and sampling date. The following are examples of ground water and well boring soil sample identification numbers:

Ground Water Sample:
Example: MN-MW1-032893

where: MN = Melville North Landfill
MW = Monitoring Well Water Sample
1 = Well Number
032893 = Sampling Date (March 28, 1993)

Boring Soil Sample:
Example: MN-B12-032893

where: MN = Melville North Landfill
B1 = Well Boring Soil Sample and Number
2 = Second Sample Interval
032893 = Sampling Date (March 28, 1993)

7.0 LAND SURVEYING

Following the completion of the field sampling activities at the site, it will be surveyed by a State of Rhode Island registered surveyor. The physical site features along with the location, elevation, and coordinates of sampling stations (outside of buildings) will be determined in the survey. Each sampling location will be referenced to the State of Rhode Island Grid Coordinate System. Completed wells will be surveyed for elevation of the top of the protective casing, top of the well casing, and the adjacent land surface. Previously completed wells, if any, will also be surveyed at this time. All elevations will be referenced to a United States Geological Survey benchmark (mean sea level -msl) and/or mean low water level (mlw).

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

APPENDIX C
HEALTH AND SAFETY PLAN

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

-Draft-
September, 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

HEALTH AND SAFETY PLAN APPROVALS

TRC Program Manager	Date
TRC Project Manager	Date
TRC Health & Safety Director	Date
Northern Division Representative	Date

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

PERSONNEL SAFETY - ACKNOWLEDGEMENT FORM

All TRC project personnel are required to make the following statement prior to conducting work at the Naval Education and Training Center, Newport, Rhode Island.

I, ____ state that:

1. I have read and fully understand the Phase II NETC Health and Safety Plan and my individual responsibilities.

2. I agree to abide by the Health and Safety provisions of this Plan.

____
Signature

____
Date

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared by TRC Environmental Corporation (TRC-EC) for application to a Phase II Remedial Investigation/Feasibility Study (RI/FS) for the Naval Facilities Engineering Command (NAVFAC), Northern Division. The HASP has been specifically developed for the Phase II RI of the Melville North Landfill site located at the Naval Education and Training Center (NETC) in Newport, Rhode Island. Maps of the NETC and the site are provided as Figures 1 and 2, respectively.

This Health and Safety Plan has been prepared to protect worker health and safety during investigation activities at the Melville North Landfill site. The HASP is intended as an update to the March, 1989 Phase I RI NETC Health and Safety Plan prepared by TRC-EC. Additional details on site-specific health and safety considerations (e.g., nature of wastes, work zones, task personnel protection levels) are provided in the site-specific Field Sampling Plan provided in Volume III, the Field Sampling Plan.

Section 2.0 of the HASP describes the anticipated hazards which may be encountered at the site. Section 3.0 discusses project staffing, organization and responsibilities. Section 4.0 describes TRC-EC's Corporate Health and Safety program and adherence to regulatory standards. Section 5.0 describes site control measures to be employed at the site to maintain order and minimize chemical and physical hazards to on-site personnel, visitors, and the public. Section 6.0 describes site Health and Safety orientation meetings, and weekly Health and Safety meeting updates. Section 7.0 describes task specific Health and Safety procedures as well as chemical and physical hazards, site monitoring, action levels, personnel protective equipment, and decontamination and disposal procedures. Lastly, Section 8.0 describes emergency procedures, emergency phone numbers, and presents a map of the route to a hospital from the site.

1.1 Project Objectives

The objective of this Work Plan is to define the level of investigation planned to assess the presence and nature of environmental contamination at the Melville North Landfill. The site investigation activities will be conducted to assess the presence of any hazardous substances, the nature of any disposed materials, and the potential for releases of contamination from the site. The findings of this RI investigation will be used to support the ecological and public health risk assessment and feasibility study activities for the Melville North Landfill.

One of the purposes of this HASP is to inform site personnel of the currently known and suspected hazards associated with work at the site. All site personnel, including subcontractors, are required to become familiar with and follow provisions of this plan. Although all employees are required to follow the guidelines set forth herein, the safety of site personnel is ultimately the responsibility of the individual and their respective employers. Copies of this HASP will be available to on-site personnel for orientation to anticipated on-site hazards (based on currently available data), as well as the health and safety procedures to be followed during implementation of this program. TRC-EC or the Navy cannot be responsible for enforcing provisions of this plan for the health and safety of site personnel other than their own employees.

To meet project objectives, field explorations will include the following activities: ambient air, soil gas and geophysical surveys; soil, sediment, surface water, and ground water sampling; and soil boring drilling and monitoring well installation activities. The field investigation activities planned for Melville North Landfill are described in the Field Sampling Plan provided in Volume III of this Work Plan.

1.2 Work Tasks

This section summarizes the Phase II field activities planned for the Melville North Landfill site.

1.2.1 Geophysical Surveys

A geophysical survey will be conducted at the site. The geophysical survey will consist of a seismic refraction survey across the site. The seismic survey will be used to determine the bedrock topography at the site.

1.2.2 Soil Sampling

Soil samples will be collected from the site. Soil samples will be collected as both surface and subsurface soil samples. Samples will be concentrated in areas identified through historic information, geophysical surveys, soil gas surveys, and/or the findings of the Phase I RI as areas of potential contamination. The objective of soil sampling will be to assess the nature and extent of soil contamination at the Melville North Landfill site. Each soil sample will also be screened for the presence of total volatile organic vapors/gases with a photoionization and/or flame ionization detector.

1.2.3 Soil Gas Investigation

A soil gas investigation will be completed at the Melville North Landfill during the Phase II RI. The planned Phase II soil gas investigation is based on the findings of the Phase I RI. The objective of the soil gas sampling is to aid in further investigating the area of subsurface soil and ground water contamination detected in Phase I.

1.2.4 Monitoring Well Installation and Development

Additional ground water monitoring wells will be installed and sampled at the Melville North Landfill site in Phase II. The findings of the Phase I RI indicate the need to further investigate areas of Phase I observed ground water contamination and the background ground water quality for the site. Thus, the overall objective of the Phase II monitoring well program is to further assess the ground water quality at the site.

1.2.5 Ground Water Sampling

Ground water monitoring wells installed at the Melville North Landfill in Phase I and those planned for installation in Phase II will be sampled. Ground water samples will be collected from all of the wells after they have been properly developed and purged. Water levels measurements will also be taken at each of the site wells routinely throughout the Phase II RI. The ground water sampling procedures are fully described in Appendix B of Volume III of this Work Plan.

1.2.6 Land Survey

Following completion of the field investigation activities, the site sampling locations will be established on a site map. The coordinates and elevations of all sample points will be determined. The site features and topography will also be located during the survey. The objective of the land survey will be to provide a map of the site which shows the main site features and all of the Phase I and Phase II sample locations. The coordinates and elevations of all sampling points will also be tabulated.

2.0 SITE HAZARD SUMMARY

Hazards which may be encountered at this site can be classified into three general categories: chemical, physical, and natural. Chemical hazards are site specific and involve potential exposure to chemical contaminants in soil, ground water, and volatilized components in air. Physical hazards are generally occupationally specific and involve some type of accident. Natural hazards are created by natural environmental circumstances such as weather, poisonous plants, poisonous animals, insect bites, etc.

2.1 Chemical Hazards

A review of the available historic information indicates a number of potential contaminants may be present at the site. Table 1 summarizes suspected contaminants at the Melville North Landfill site.

The potential for exposure to site contaminants could result from inhalation, ingestion, or direct contact (skin absorption) with soils or waters contaminated with volatile organic hydrocarbons. Common symptoms of acute exposure to VOCs include headaches, dizziness, nausea, eye irritation, fatigue, loss of coordination, visual disturbances, abdominal pains, and cardiac arrythmia. Chronic exposures to solvents, hydrocarbons, and lead can lead to skin diseases; nervous and respiratory system disorders; kidney, liver, brain, and heart malfunctions; and cancer.

Potential contaminants from former site use activities that may be encountered are summarized in the site background section of the Field Sampling Plan. Below is a summary of the known site contaminants based upon the findings of the Phase I RI.

Soil Assessment - Volatile organic compounds (VOCs), base neutral/acid extractable organic compounds (BNAs) (including polynuclear aromatic hydrocarbons (PAHs)), pesticides, PCBs, and inorganics were all detected in on-site soils. The major areas of the site where contaminants were detected in the soils at elevated levels include the following:

Northwestern area - BNAs, PCBs;
Northeastern area - PCBs, inorganics;

- North-central area - inorganics;
- Central area - VOCs, BNAs, pesticides, PCBs and inorganics; and
- South of access road - VOCs, BNAs, PCBs, and inorganics.

Significant VOC contamination (i.e., greater than 1 ppm total VOCs) was detected in subsurface soils in the central portion of the site, in the suspected area of former lagoons, and in the southern portion of the site at well boring 4. Soil samples collected in the former lagoon area and from well boring 4 generally exhibited strong petroleum odors and/or visible oil contamination. BNAs were detected at elevated levels (i.e., greater than 10 ppm total BNAs) in the northwest, central and southern portions of the site.

Pesticides were detected at low levels (i.e., 10's of ppb) in surface soil samples across the site with higher levels (100's of ppb) detected in the central portion of the site. PCBs were detected in surface and subsurface soils. PCBs were detected above the 1 ppm RIDEM PCB soil action level in surface soils in the northwest and northeast portions of the site, and in subsurface soils in the central and southern portions of the site.

Inorganics were detected in soil samples collected from the northeast corner of the site to just south of the site access road at levels exceeding background levels. The highest inorganic levels were detected in subsurface soils generally collected at or below the water table from the north-central and central to south-central portions of the site.

Ground Water Assessment - VOCs, BNAs, pesticides, PCBs, and inorganics were all detected in ground water samples. The major areas of the site where contaminants were detected at levels exceeding action levels include the following:

- North-central area - inorganics;
- Central area - VOCs, and inorganics; and
- South of access road - VOCs, BNAs and PCBs.

VOC detections at concentrations exceeding ground water action levels, consisting mostly of petroleum-related VOCs (xylene, benzene), were limited to wells located in the central (MW-3) and southern (MW-4) portions of the site. Oil was also identified in well MW-3. VOCs were also detected in soil boring samples collected at the depth of the water table from the central and southern portions of the site, and signs of petroleum related contamination (e.g., odors, oil) were observed during the drilling and sampling of these borings. One BNA compound was detected above ground water action levels in a well (MW-4) in the southern portion of the site. A pesticide, gamma-BHC, was detected in ground water at well MW-4.

A PCB concentration of 40 ppb was also detected in well MW-4 (PCBs were detected in the soil from this well boring). PCBs were also detected at 0.13 ppb, less than the MCL, in MW-3 in the central portion of the site. While inorganic concentrations exceeded ground water action levels in most wells, the highest levels of inorganic analytes were detected in ground water in the central to north-central portions of the site.

Sediment Sample Assessment - VOCs, BNAs, pesticides, and inorganics were detected in sediment samples. The sediment samples were collected from the swampy area at the northern edge of the site. The contaminants detected at elevated levels in the sediment included carcinogenic PAHs, pesticides, and inorganics

The maximum total VOC concentration detected in the sediment was 11 ppb, well below the contaminant-comparison level of 1 ppm. The maximum total BNA concentration detected was 5.43 ppm, also below the contaminant-comparison level of 10 ppm. However, total carcinogenic PAH levels in two samples exceeded the contaminant-comparison level of 1 ppm. Pesticides were detected in each of the sediment samples, with 4,4'-DDE detected at each location at concentrations ranging from 7.9 to 470 ppb. Inorganic analytes were detected at elevated concentrations at each sample location, although different analytes exceeded background at each location.

The complete list of contaminants of concern at the Melville North Landfill site, as determined in the Phase I Human Health Risk Assessment, is provided in Table 1.

2.2 Physical Hazards

Primary physical hazards at the site are those associated with drilling and excavation activities. Hazards that could be encountered during subsurface explorations include falls and trips, injury from lifting heavy objects, falling objects, eye injuries, head injuries, and pinched or crushed hands and feet. A fire hazard may also be present due to the use of gasoline-powered equipment, and the possible presence of flammable materials in subsurface soils.

2.3 Natural Hazards

Natural hazards such as weather, poisonous plants, animals, and insects cannot always be avoided. Based on available information and current site conditions, the site safety officer and field personnel shall use their best judgement to avoid these potential hazards.

Natural hazards also include exposure to adverse weather conditions including heat and cold stress. Methods of symptom recognition, preventive measures, and first aid methods for cold and heat stress are provided as an attachment to this HASP.

3.0 STAFF RESPONSIBILITIES

3.1 Project Staff Responsibilities

TRC-EC staff listed below will be responsible for the respective activities listed.

3.1.1 Program Manager

- Holds ultimate responsibility for satisfactory completion of the project.
- Reports status of field activities to the Navy Northern Division Engineer-In-Charge.

3.1.2 Project Manager

- Provides overall project management and control.
- Maintains day-to-day liaison with NETC Environmental Coordinator and subcontractors.
- Notifies NETC Environmental Coordinator of any site emergencies.
- Prepares, reviews, and transmits project documents to the Navy.
- Conducts the initial health and safety site orientations.

3.1.3 Health and Safety Director

- Assists in the development and review of the HASP.
- Provides on-going industrial hygiene support to the Project Manager.
- Reviews and approves significant changes and/or deviations to the HASP.
- Provides consultation to the Project Manager on technical aspects of the HASP and its implementation.

3.1.4 Field Operations Manager

- Coordinates and supervises fieldwork.
- Reports daily progress of fieldwork to the Project Manager.

Notifies Project Manager of deviations from the Health and Safety Plan.

- Assures that fieldwork proceeds according to Health and Safety Plan requirements.
- Designates On-Site Coordinator (OSC)

3.1.5 On-Site Coordinator (OSC)

- Primary responsibility for notification of and transport of injured field personnel to a hospital in the event of an accident.
- Monitors field investigations to ensure compliance with the approved HASP.
- Recommends modification of the HASP to the Project Manager as soon as practical after it is apparent that the Plan should be modified.
- Keeps non-essential personnel outside study zone boundaries. Logs in the field notebook personnel who enter into the study zone.
- Appoints alternate on-site coordinator on an as needed basis.
- Uses appropriate portable field instruments to monitor site conditions during investigatory activities.
- Maintains a log of field activities, monitoring data, and site meetings.

3.1.6 On-Site Coordinator - Alternates(s)

- Assumes all functions and responsibilities of the OSC in his/her absence.

3.1.7 Subcontractors

- Immediately notify the Field Operations Manager or On-Site Coordinator of hazardous or potentially hazardous conditions or environments that are not addressed or not adequately addressed in the HASP.
- Conduct work in a safe manner.

4.0 REGULATORY REQUIREMENTS AND PERSONNEL QUALIFICATIONS

To be authorized for field explorations, TRC-EC field personnel and subcontractor field personnel (drilling and soil gas contractors) must meet the minimum requirements described in these subsections. Documentation of the requirements described below will be maintained by TRC-EC for TRC-EC personnel involved in field activities. Subcontractors and regulatory personnel are responsible for maintaining the required documentation for their field personnel.

4.1 Medical Monitoring

In compliance with OSHA medical monitoring regulations (29 CFR 1910.120), field supervisory personnel and field sampling personnel shall have received an examination by a licensed occupational physician. The most recent exam shall have been received within the 12-month period proceeding this work, and each employee shall have been determined by the attending physician to be physically able to perform the work and to use respiratory and other protective equipment as required for field investigations.

4.2 Health and Safety Training

Field personnel shall have received training and/or experience which, at a minimum, satisfies the OSHA regulations for hazardous waste and emergency response (29 CFR 1910.120).

4.3 Respirator Training

All personnel who enter the Exclusion Zone shall have completed a respiratory protection program which, at a minimum, satisfies the OSHA regulations (29 CFR 1910.134). This program shall include: 1) instruction in the proper use and limitations of respirators; 2) proper fitting of personnel for a respirator, using a qualitative or quantitative fit test method; and 3) teaching personnel how to conduct a positive and/or negative pressure fit test. The respirator which is used to fit test personnel will be individually assigned and available for site work. TRC-EC provides respiratory protection to employees involved in activities at work locations where the presence of respirable hazards is known or suspected.

Field staff assigned to this project shall be capable of using and inspecting a cartridge respirator. All field staff shall have their own personal respirator. The maintenance of that respirator shall be the responsibility of the individual. OSHA requires that respirators be inspected both before and after use and that respirators not used routinely shall be inspected after use and at least monthly. At the time the respirator is issued and used, the individual receiving it shall test the fit (qualitatively), and inspect the gaskets, exhalation valve, face shield, head straps, and cartridges.

Individuals are responsible for cleaning/disinfecting their respirators. Acceptable procedures include washing using respirator-approved detergent/disinfectant in warm water and rinsing or air drying in a clean place. Respirators will be used on a site specific basis as described in Section 7.0.

5.0 SITE ACCESS AND CONTROL

The Melville North Landfill site consists of a parcel of land approximately 8 acres in size located just off of Defense Highway and adjacent to Narragansett Bay. Access to the site is off of Defense Highway through a gate and along a small paved road. The paved road leads down a small hill, over railroad tracks, and to the site which is along the waterfront.

The purpose of the site control measures presented in this section are to maintain order at the site and to minimize chemical and physical hazards to on-site personnel, visitors, and the public. Three work zone/areas will be established for the site: a support zone, a decontamination zone, and an exclusion zone. The site-specific access considerations and work zones established for each of the site investigations are presented in the Field Sampling Plan in Volume III of this Work Plan. Below are general descriptions of each of the three work zones.

5.1 Support Zones

The support zones are considered "clean areas" and provide areas or locations where field personnel can take breaks and store field investigation equipment. The support zones also contain site safety and emergency supply equipment (e.g., first aid kits, eye wash units, HASP) and field communication equipment (e.g., mobile phone, walkie talkie).

The support zone will consist of the on-site personnel vehicles and an off-site field office trailer. The field office trailer will be located at Site 13, Tank Farm Five. This field office trailer will be the command center for the site field investigation activities. The field investigation team will be provided with communication equipment (e.g., mobile phone, walkie talkie) for maintaining contact with the field office trailer.

5.2 Exclusion Zones

During the field investigation activities, the exclusion zone will consist of the entire site outside of the adjoining support and decontamination zones. At the off-site investigation locations (e.g., monitoring well locations), the exclusion zone will consist of a 25-foot area surrounding the active investigation operations (e.g., drilling).

The OSC or alternate will be responsible for keeping nonessential personnel outside the exclusion zone boundaries. In the event that visitors or unauthorized personnel are present during field activities, the OSC or alternate shall verbally request that they maintain a safe distance outside of the exclusion zone. Prior to entering the exclusion zone, site personnel shall have donned the proper personnel protective equipment (PPE) for expected site conditions, as outlined in Section 7.0, or as determined by the OSC or alternate.

5.3 Decontamination Zone

A contamination reduction station, or decontamination zone, will be established adjacent to the exclusion zone. The decontamination zone will be established at the upwind side of the exclusion zone and will consist of a taped off area adequate in size to comfortably contain decontamination equipment. Personnel exiting the exclusion zone shall undergo appropriate decontamination, if required by the task-specific procedures described in Section 7.0. A heavy equipment (e.g., drill rigs, augers, rods) decontamination area for the site will be located on Site 01, McAllister Point Landfill, at the area established in Phase I. Disposal of investigation derived waste materials is described in Appendix E of this Work Plan.

6.0 GENERAL HEALTH AND SAFETY WORK PRECAUTIONS

6.1 Health and Safety Site Orientation

All site investigation personnel shall be required to read this HASP and attend the Health and Safety Site Orientation meeting. Documentation of attendees will be maintained as part of project records. The HASP will accompany field personnel to each site and shall be maintained at a location known to each individual working on-site.

The Project Manager or OSC will conduct a health and safety site orientation prior to the initiation of field activities. The orientation will cover all aspects of this HASP. Particular emphasis will be placed on a review of potential site contaminants and their potential health effects; accident prevention; safe work procedures; precautionary measures; use of personnel protective equipment; and emergency response procedures. All field staff are required to attend.

6.2 Health and Safety Briefings

The OSC or alternate will conduct a Health and Safety Briefing on a routine basis. Topics to be covered include personnel protective equipment, personnel and equipment decontamination procedures, accident prevention, and any modifications or amendments to the Health and Safety Plan. All field staff are required to attend. A Safety Meeting Summary Form documenting personnel attending each meeting will be maintained in project files.

7.0 TASK-SPECIFIC HEALTH AND SAFETY PROCEDURES

7.1 General

The following general health and safety procedures will be employed for work conducted at the Melville North Landfill site.

7.1.1 Chemical and Physical Hazards

The activities which do not involve subsurface activities (geophysical and land surveys) could result in the exposure of workers to contaminated surface soils or vapors. Such an occurrence can lead to worker exposure via inhalation or permeation through the skin (skin absorption). However, in general, non-invasive activities do not require direct contact with site soils and/or waters, and therefore exposures are anticipated to be minimal.

7.1.2 Site Monitoring

The OSC shall use an HNu PI-101 (or equivalent) photoionization detector (PID) (or flame ionization detector - FID, OVA 128, or equivalent) to monitor organic vapors in the breathing zone at the upwind boundary of the Exclusion Zone at the beginning of each day, to establish a daily background reading.

The federal regulation 20 CFR Part 1910.120 (h)(2-3) indicates air monitoring is required upon initial entry, and periodic monitoring shall be conducted when the possibility of an immediately dangerous to life and health (IDLH) condition exists or when there is an indication that exposures may have risen over permissible or published limits since prior monitoring. The air monitoring program conducted on site is intended to be consistent with these requirements.

7.1.3 Action Levels

All field work will begin in personnel protective gear as defined in the site Field Sampling Plan provided as Volume III. Based on the PID/FID readings in the breathing zone, or site conditions, the OSC shall upgrade or downgrade Personnel Protective Equipment (PPE) requirements as described below.

The following action levels are based on PID breathing zone readings:

- 0 to 1 PID unit above background: Level D
- 1 to 5 PID unit above background for longer than one minute: Modified Level D
- 5 to 25 PID units above background: Level C
- 25 PID units or greater: discontinue operations. Make arrangements to continue work in Level B protective equipment or use Level B to retrieve/demobilize equipment.

The OSC may also make the decision to upgrade the PPE requirements, even if positive PID readings are not noted. This decision will be based on site conditions including visual or sensory observation of soil or ground water contamination, or other site hazards.

Action levels were set below the PEL's/TLV's of the most abundant substances suspected at the sites.

7.1.4 Personnel Protective Equipment (PPE)

This section contains specific provisions for the use of Personnel Protective Equipment (PPE). It shall be the responsibility of the OSC to make the determination of the level of PPE to be used by personnel within the Exclusion Zone. The decision of the OSC will be based on site monitoring (Section 7.1.2), action levels (Section 7.1.3), knowledge of the site, and observed site conditions. Changes affecting the level of PPE defined in the HASP will be at the direction and approval of the TRC-EC Project Manager and/or TRC-EC Director of Health and Safety, except in the case of an emergency during which time it will be the responsibility of the On-Site Coordinator to modify PPE levels.

The following is a discussion of the anticipated levels of personnel protection based upon historical information and the findings of the Phase I RI.

Level D personnel protection will be used at the start of most non-intrusive field work (e.g., surface soil sampling, geophysics). Level D protection shall include use of the following items:

- work clothes;
- hard hat;
- work boots; and
- chemical protective gloves when collecting soil and water samples (solvex/nitrile).
- inner glove liners (latex/vinyl)

Level D protection may also include the use of a polycarbonate faceshield, attached to the hard hat, in the event that potential splash conditions are present. Splash conditions are most likely to be present during decontamination of heavy equipment. Use of the splashguard shall be at the discretion of the OSC.

A Modified Level D, which includes Level D plus additional PPE (e.g., tyvek, boot covers), will be during subsurface investigation o intrusive activities (drilling, soil gas).

An upgrade to Level C may be necessary if the concentration of VOCs detected in the breathing zone of the workers exceeds the action level of 5 PID units discussed in Section 7.1.3, or if warranted by other site conditions. Level C protection will include all of the PPE required for Modified Level D plus appropriate respiratory protection. The specific respirator to be used for Level C protection shall be a NIOSH-approved respirator with compatible cartridges. Respirator cartridges will be changed at the first sign of break through, or daily at a minimum, when in use.

It is anticipated that protective Level D or Modified Level D will be appropriate for carrying out most work tasks related to this project. A sufficient inventory of necessary equipment will be maintained on-site to provide these levels of protection for all site personnel who must work within the Exclusion Zone.

7.1.5 Decontamination

Upon leaving the Exclusion Zone, personnel must undergo appropriate decontamination. The nature of the decontamination requirements will depend on the nature of the work conducted and whether immediate re-entry into the Exclusion Zone is planned, or if complete egress from the Exclusion Zone is intended.

The personnel decontamination requirements will also depend on the level of protection used within the Exclusion Zone and the suspected degree of contamination. This area will be located immediately outside the access opening of the Exclusion Zone on its apparent upwind side. This area shall contain the decontamination station necessary to allow rest breaks and respirator cartridge changes (if appropriate), as well as for complete decontamination as required for food and beverage breaks, or exiting the work area. Periodic air monitoring will be conducted in the contamination reduction zone (decontamination area) when this area is used.

Equipment decontamination will occur in designated areas. The heavy equipment decontamination for the site will occur in a designated area on Site 01, the McAllister Point Landfill. Field decontamination of other sampling equipment will occur at locations designated for the site. Most of the field sampling equipment (e.g., spoon, bailers) will be laboratory decontaminated to, in part, reduce the amount of field-generated waste. The equipment decontamination procedures are described in the QAPP in Appendix D.

7.1.6 Field Generated Waste Handling

The handling of materials generated during site activities (e.g., drill cuttings, purge/development water, PPE) will be conducted as described in the Investigation Derived Waste Plan contained in Appendix E of this Work Plan. All site visitors (e.g., regulators, auditors) shall dispose of their expendable PPE along with that of the field investigation personnel.

7.2 General Site Media Sampling

This section describes the health and safety considerations for all general or non-intrusive site sampling activities. Such activities would include surface soil sampling, sediment sampling, and ground water sampling.

7.2.1 Chemical Hazards

General non-intrusive media sampling activities at the site will include the collection of the following samples types: surface soil, sediment, and ground water. These activities may result in the exposure of workers to potentially contaminated soils/sediments and ground water, washwater from decontamination of personnel protective equipment, and vapors released from site media. Such an occurrence can lead to worker exposure via inhalation, ingestion, and permeation through the skin (skin absorption). Proper PPE and monitoring will be used during the field investigation activities to reduce the potential for chemical exposures.

7.2.2 Site Monitoring

During non-intrusive sampling activities, the OSC or designee shall use a PID/FID to monitor the following:

- At each soil sampling point or monitoring well prior to sampling.
- The site workers breathing zone continuously during active sampling activities.

7.2.3 Action Levels

Unless otherwise determined by OSC, Level D protection will generally be used for non-intrusive media sampling tasks. However, for ground water sampling activities, a minimum of Modified Level D protection will be used by sampling personnel. Based on PID readings measured in the breathing zone or site conditions, the OSC shall upgrade or downgrade Personal Protective Equipment (PPE) requirements. Action levels to be used for media sampling activities were previously outlined in Section 7.1.

7.2.4 Personnel Protective Equipment (PPE)

Based on site conditions and action levels described in Section 7.1, the OSC shall upgrade personnel protective requirements commensurate with site hazards. The OSC may also make the decision to upgrade or downgrade the PPE requirements, even if positive PID readings are not noted. This decision will be based on site conditions including visual or sensory observations of potential contamination. In particular, the presence of free product or other contaminants in ground water, soil, or sediment may require an upgrade of PPE requirements.

7.2.5 Exclusion Zone

In recognition of the increased risk to workers of exposure to contaminated soils or ground water, a secondary exclusion zone of approximately 10 feet will be established around all sampling activities. Nonessential personnel shall be prohibited from entering the secondary exclusion zone. Monitoring results will be considered when establishing exclusion zone boundaries. In general, if elevated readings are encountered, the exclusion zone will be enlarged from that described in the plan and if no detectable readings are encountered the exclusion zone will remain as described above.

7.3 Subsurface Exploration Activities

This section describes the health and safety considerations for all subsurface or intrusive investigation activities. Such activities planned for this site would include subsursurface soil sampling (i.e., drilling), and soil gas sampling

7.3.1 Chemical and Physical Hazards

Subsurface exploration activities include soil boring activities. These activities may results in the exposure of workers to potentially contaminated soils and ground water, washwater from decontamination of personnel protective equipment, and vapors released from contaminated site media. Such an occurrence can lead to worker exposure via inhalation, ingestion, and permeation through the skin (skin absorption).

7.3.2 Site Monitoring

The OSC shall use a PID or FID to:

- Monitor organic vapors in the breathing zone at the upwind boundary of the Exclusion Zone at the beginning of each day, to establish a daily background reading.
- Monitor organic vapors in the worker's breathing zone during active subsurface explorations.
- Monitor the workers breathing zone at fifteen-minute intervals or continuously during active subsurface explorations, if elevated levels of organic vapors are detected.
- Downhole organic during split spoon sampling activities.

Other monitoring equipment will include an combustible gas/oxygen meter to monitor the ambient air and downhole vapors to monitor for explosive vapors and oxygen content.

7.3.3 Action Levels

Unless otherwise determined by the OSC, Modified Level D protection shall be used for the site subsurface exploration tasks (e.g., drilling, soil gas). Based on positive PID/FID readings in the breathing zone or site conditions, the OSC shall upgrade Personal Protective Equipment (PPE) requirements, as appropriate.

Action levels to be used for subsurface exploration activities are outlined in Section 7.1. Additional action levels for the combustible gas/oxygen meter are as follows:

A. If airborne concentrations of flammable vapors exceed 10 percent of the lower explosive limit (LEL), no ignition sources will be permitted in the area.

B. If ambient conditions exceed 25 percent of the LEL at a distance of one foot from the source, or ten percent at a distance of two feet or greater, then site operations will be halted and appropriate corrective actions (e.g., ventilate hole, abandonment and backfill boring) will be taken.

7.3.4 Personnel Protective Equipment (PPE)

Based on site conditions and action levels described in Section 7.1 above, the OSC shall upgrade or downgrade personnel protective requirements commensurate with site hazards. The OSC may also make the decision to upgrade the PPE requirements, even if positive PID requirements are not noted. This decision will be based on site conditions including visual or sensory observations of potential contamination.

During initial subsurface exploration activities and well installation activities, Modified Level D protection will be required. Necessary equipment for Modified Level D protection will include that of Level D plus the additional PPE listed below:

- chemically resistant boots, PVC/rubber overboots, or disposable boot covers;
- Tyvek or equivalent jump suit (with ankles and wrists duct taped);
- chemically protective outer gloves (solvex/nitrile); and
- inner glove liners (latex/vinyl).

If odorous soils are detected during subsurface explorations the following procedures will be instituted:

- if PID or FID readings of auger spoils are consistently above 5 PID units, the air monitoring frequency will be increased; and,

- a change, if necessary, to the appropriate PPE will occur.

7.3.5 Exclusion Zone

In recognition of the increased risk of physical injury and exposure to chemical contaminants during subsurface investigation activities, a secondary exclusion zone of a minimum of approximately 25 feet shall be established around exploration equipment (i.e., drill rig, backhoe). Nonessential personnel shall be prohibited from entering the exclusion zone. All personnel entering the exclusion zone will be required to wear appropriate personnel protective equipment.

8.0 EMERGENCY RESPONSE

8.1 Emergency Information

A list of emergency phone numbers will be maintained at the site during active investigation activities. In addition, a copy of this HASP will accompany field personnel to the site and shall be maintained at a location known to each individual working on-site.

The Newport Hospital is the nearest medical facility. A map with a suggested route to the hospital is provided along with emergency phone numbers are provided in Figure 3 and Table 3, respectively.

The Newport Hospital will accept and treat (to the extent it is capable) workers exposed to various suspect substances or physically injured at the project site.

In the event of a site emergency, the OSC or alternate shall evacuate site personnel to a safe area and then contact the appropriate authorities listed above. As soon as practical, after contacting the authorities and ensuring the safety of site personnel, the OSC shall contact the TRC-EC Project Manager.

8.2 General Procedures

An OSHA approved first aid kit, eye wash bottles, and a fire extinguisher rated for Class A, B and C fires will be present within or near the Exclusion Zone during subsurface explorations. It shall be the responsibility of the OSC to make a determination as to the proper response for a particular emergency. As soon as practical after emergency response, the OSC shall brief the Project Manager as to the nature of the incident, and response actions taken. The OSC, Project Manager, and Health and Safety Director, shall evaluate the site conditions and make a determination regarding any measures that could be taken in the future to prevent incidents of a similar nature from being repeated. The Project Manager shall notify the NETC Environmental Coordinator regarding site emergencies.

8.3 Emergency Response Plan - Specific Incidents

8.3.1 Chemical Exposures

Inhalation

- If site personnel experience symptoms suggesting exposure to toxic chemicals (light-headed, dizziness, headache, nausea, shortness of breath or burning sensation in the mouth, throat or lungs), the person should be immediately escorted from the contaminated environment to fresh air.

- If unconscious, the victim should be removed from the contaminated area immediately and brought to the nearest hospital. Rescuers shall wear appropriate Personnel Protective Equipment during rescue.

- If the victim is no longer breathing, he/she shall be moved away from the contaminated area. Immediate mouth-to-mouth resuscitation or some alternate form of effective artificial respiration shall begin.

- If the victim has no pulse, he/she shall be moved away from the contaminated area and cardiopulmonary resuscitation (CPR) should begin immediately. It may be necessary for the victim to receive artificial resuscitation and CPR simultaneously.

Should any of the above scenarios be encountered, emergency medical attention/advice must be obtained immediately. The TRC-EC Project Manager should be notified of the situation and the affected individual(s) status as soon as practical.

Skin Exposure

If there is skin contact with toxic or potentially toxic chemicals, the skin should be washed with copious amounts of soap and water. If clothing is contaminated, it should be removed immediately and the skin washed thoroughly with running water. All contaminated parts of the body should be thoroughly washed. It may be necessary to wash repeatedly.

Ingestion

If site personnel ingest known toxic chemicals or suspected contaminated materials, obtain medical attention immediately.

Eye Exposure

If foreign matter should get into the eyes they should be flooded with water so that all surfaces are washed thoroughly. Washing should be continued for at least fifteen minutes. Medical attention should be obtained immediately.

8.3.2 Injury of Personnel

At a minimum, one person on site will be trained in Standard Red Cross First Aid. In the event of an emergency, this person will administer appropriate first aid and arrange transportation for injured personnel to the designated medical facility, if necessary. This person will evaluate the site conditions to determine if the causal hazard still exists. Site personnel shall not re-enter the Exclusion Zone until the cause of the injury is determined, and the Exclusion Zone is designated safe to re-enter.

8.3.3 Fire/Explosion

In the event of a fire or explosion, the OSC shall alert the NETC Fire Department by calling from a phone nearby the affected area. All personnel shall move to a safe distance from the involved area. The OSC shall make a determination regarding the severity of the fire, and whether site personnel shall attempt to extinguish it. Fires shall not be fought by site personnel if an explosion hazard is present or if a large fire is present on this site.

TABLES

TABLE 1
SUMMARY OF CONTAMINANTS
MELVILLE NORTH LANDFILL

COMPOUND NAME	RANGE OF SURFACE SOIL SAMPLES (mg/kg)	RANGE OF SUBSURFACE SOIL SAMPLES (mg/kg)	RANGE OF GROUND WATER SAMPLES (ug/L)
INORGANICS			
Antimony	4.9–50.4	3.5–1898	ND
Arsenic	2.1–23.4	1.3–35.95	3.3–22.4
Barium	6.5–269	6.7–1360	59.4–759
Beryllium	0.19–0.52	0.16–1.4	1.1–3.8
Cadmium	0.6–1.2	0.51–32.9	10.1–14.7
Chromium	5.1–35.2	4.6–274	5.7–121
Cobalt	3.2–16.7	1.8–74.3	32.9–192
Copper	12.2–206	10.5–24400	32.5–958
Lead	10.2–400.5	1.0–6920	23.5–960
Magnesium	959–4530	709–4180	9690–34400
Mercury	0.14–1.1	.12–2	0.38–1.8
Nickel	6–32.2	4.5–427	126–221
Thallium	0.58–1.6	X 0.3–9.1	4
Vanadium	12.5–53.8	7.8–645	137–203
Zinc	29.9–547	20–23935	126–4170
VOLATILES			
1,1–Dichloroethene	X 0.006–0.007	X 0.006–0.04	X 5
1,1,1–Trichloroethane	X 0.006–0.008	0.006–0.2	X 5
1,1,2–Trichloroethane	X 0.006–0.008	X 0.006–0.04	X 5
1,1,2,2–Tetrachloroethane	0.006–0.008	X 0.006–0.04	X 5
1,2–Dichloroethane	X 0.006–0.007	X 0.006–0.04	X 5
1,2–Dichloropropane	X 0.006–0.007	X 0.006–0.04	X 5
1,3–Dichloropropene (Cis)	X 0.006–0.008	X 0.006–0.04	X 5
1,3–Dichloropropene (Trans)	X 0.006–0.008	X 0.006–0.04	X 5
2–Butanone	ND	0.007–1.7	X 10
2–Hexanone	0.012–0.016	X 0.011–1.6	X 10
4–Methyl–2–Pentanone	0.012–0.016	X 0.011–1.6	X 10
Acetone	0.19	0.24–6.2	X 10
Benzene	X 0.006–0.008	0.006–0.32	3–49
Bromodichloromethane	X 0.006–0.008	X 0.006–0.04	X 5
Bromoform	X 0.006–0.008	X 0.006–0.82	X 5
Carbon Tetrachloride	X 0.006–0.008	X 0.005–0.04	X 5
Chlorobenzene	0.006–0.008	0.005–1.5	X 5–79
Chloroform	0.006–0.007	X 0.006–0.04	X 5
Chloromethane	X 0.012–0.014	X 0.011–0.079	X 10
Dibromochloromethane	X 0.006–0.008	X 0.006–0.04	X 5

X : Values "UJ" qualified data only
ND : Not Detected

TABLE 1 (continued)
SUMMARY OF CONTAMINANTS
MELVILLE NORTH LANDFILL

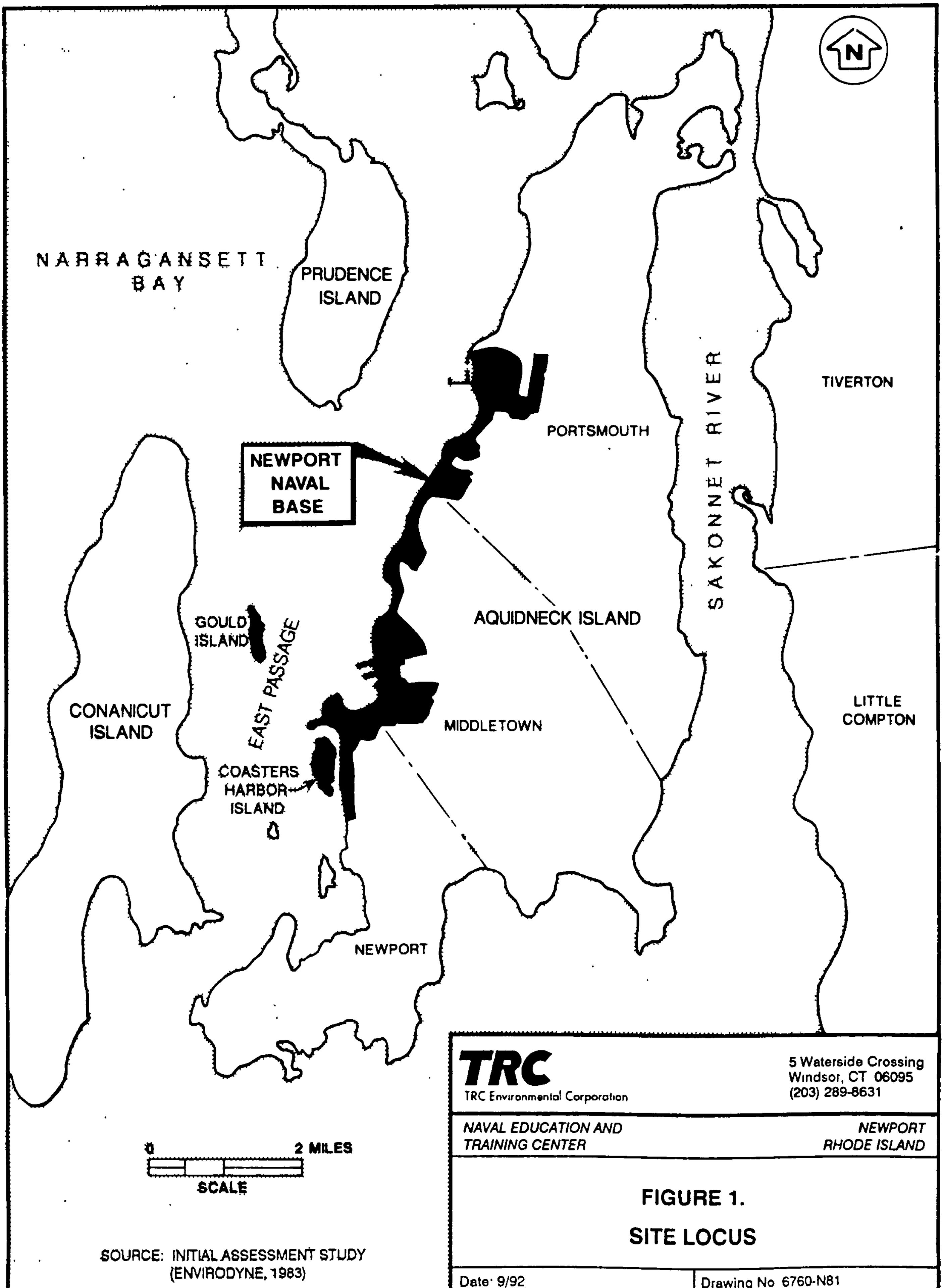
COMPOUND NAME	RANGE OF SURFACE SOIL SAMPLES (mg/kg)	RANGE OF SUBSURFACE SOIL SAMPLES (mg/kg)	RANGE OF GROUND WATER SAMPLES (ug/L)
VOLATILES (cont)			
Ethylbenzene	0.006–0.008	0.006–2.3	5–44
Methylene chloride	ND	ND	ND
Styrene	0.006–0.008	X 0.006–0.04	X 5
Tetrachloroethene	0.001–0.008	0.004–0.04	X 5
Toluene	0.002–0.008	0.001–0.72	5–6
Trichloroethene	X 0.006–0.008	0.002–0.04	X 5
Vinyl chloride	X 0.012–0.014	0.006–0.079	X 10
Xylenes	0.006–0.008	0.003–11.0	5–110
SEMIVOLATILES			
1,3–Dichlorobenzene	ND	1.6	14
1,4–Dichlorobenzene	ND	7.9	83
2–Methylnapthalene	0.12–1.2	0.1–24.0	9–210
2,4–Dinitrophenol	ND	X 11.0	ND
3–Nitroaniline	ND	X 2.0–13.0	ND
3,3'–Dichlorobenzidine	ND	X 0.79–5.2	ND
Acenaphthene	0.047–0.37	0.12–5.5	17
Acenaphthylene	0.045–1.5	0.410–2.2	ND
Anthracene	0.078–2.0	0.066–4.0	12
Benzo(a)anthracene	0.087–9.8	0.074–6.8	ND
Benzo(a)pyrene	0.081–7.5	0.059–5.6	ND
Benzo(b)fluoranthene	0.069–6.4	0.078–4.8	ND
Benzo(ghi)perylene	0.2–3.4	0.06–3.7	ND
Benzo(k)fluoranthene	0.081–6.8	0.062–3.6	ND
Bis(2ethylhexyl)phthalate	ND	X 0.4–2.1	13
Chrysene	0.057–11.0	0.044–6.4	ND
Dibenzo(a,h)anthracene	0.022–1.6	0.40–2.1	ND
Fluoranthene	0.068–15.0	0.053–18	ND
Fluorene	0.064–2.5	0.12–10.0	ND
Indeno(123cd)pyrene	0.24–3.3	0.081–3.2	ND
Naphthalene	0.046–0.45	0.068–17.0	7–100
Phenanthrene	0.048–14.0	0.067–28.0	11–62
Phenol	ND	0.22–0.33	ND
Pyrene	0.057–15.0	0.041–15.0	20

X : Values "UJ" qualified data only
ND : Not Detected

TABLE 1 (continued) SUMMARY OF CONTAMINANTS MELVILLE NORTH LANDFILL			
COMPOUND NAME	RANGE OF SURFACE SOIL SAMPLES (mg/kg)	RANGE OF SUBSURFACE SOIL SAMPLES (mg/kg)	RANGE OF GROUND WATER SAMPLES (ug/L)
PESTICIDES			
4,4'-DDD	0.005	0.0056	ND
4,4'-DDE	0.0062-0.13	0.0024-0.0047	ND
4,4'-DDT	0.018-0.45	0.0036-0.017	ND
PCB's			
Aroclor-1260	0.043-8.0	0.24-27.0	0.22-40

X : Values "UJ" qualified data only
ND : Not Detected

FIGURES



TRC
TRC Environmental Corporation

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NAVAL EDUCATION AND TRAINING CENTER

NEWPORT RHODE ISLAND

FIGURE 1.

SITE LOCUS

Date: 9/92	Drawing No 6760-N81

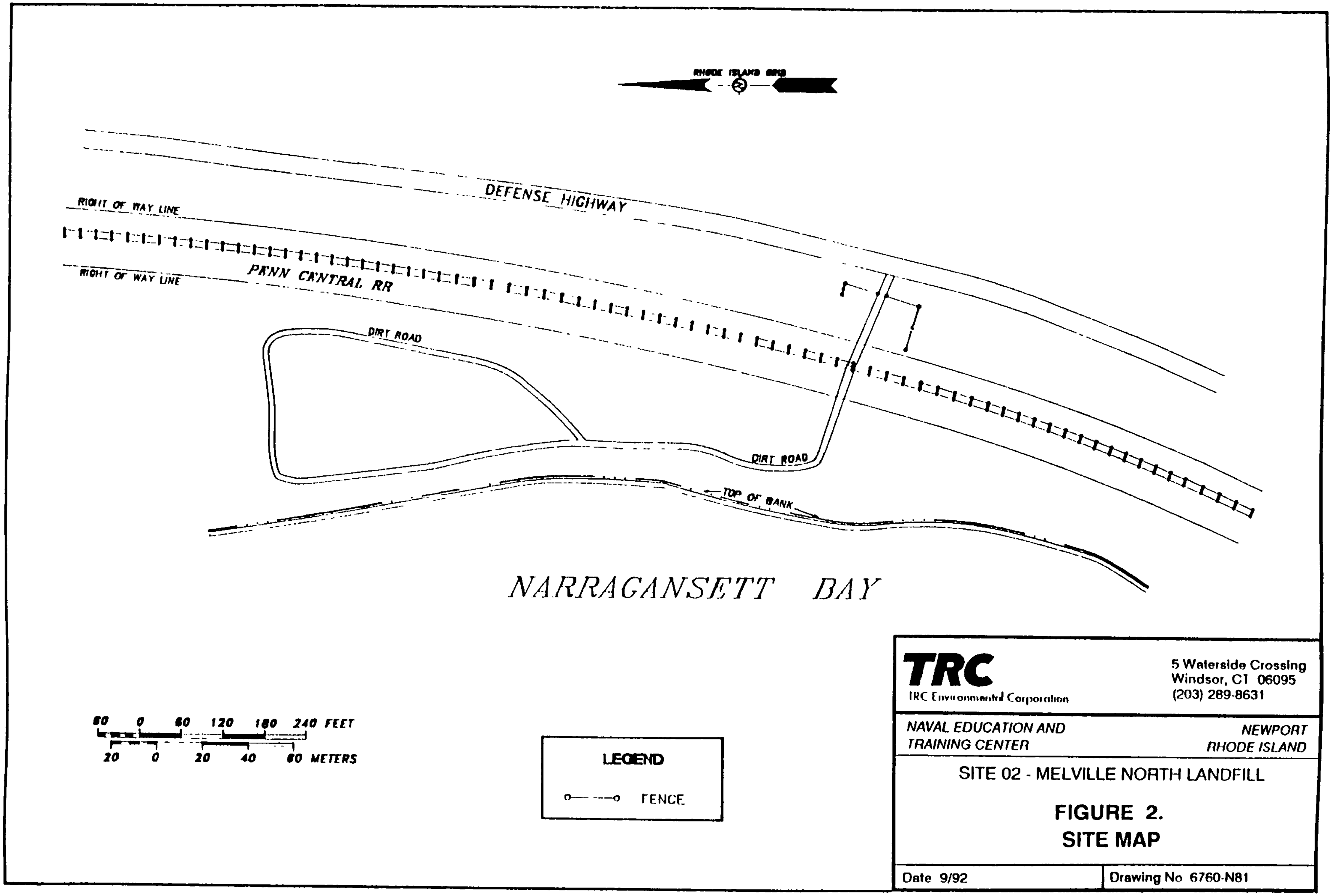


FIGURE 2.
SITE MAP

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

APPENDIX D
QUALITY ASSURANCE PROJECT PLAN

PHASE II RI/FS WORK PLAN
MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared For:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

QUALITY ASSURANCE PROJECT PLAN (QAPP) APPROVAL SHEET

PHASE II RI/FS WORK PLAN
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

September 1992

Approved by:	TRC-EC Project Manager	Signature	Date
Approved by:	TRC-EC QA Officer	Signature	Date
Approved by:	Laboratory QC Coordinator	Signature	Date
Approved by:	Engineer-In-Charge Northern Division Naval Facilities Engineering Command	Signature	Date
Approved by:	Northern Division QA Officer	Signature	Date
Approved by:	NETC Environmental Coordinator	Signature	Date

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1.0 PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) has been developed for use in conjunction with Phase II Remedial Investigation sampling activities at the Naval Education and Training Center (NETC) in Newport, Rhode Island. This Phase II sampling program builds on the findings of previous site studies conducted at NETC-Newport under the Navy Assessment and Control of Installation Pollutants (NACIP) program. Previous site studies included an Initial Assessment Study (IAS) conducted in 1983, and the first phase of the NACIP Confirmation Study procedure, the Verification Step study, which was completed in 1986, and the Phase I Remedial Investigation which was completed in 1991.

Navy policy calls for following EPA guidance and procedures while conducting investigations and remedial action at all Navy waste sites. The specific tasks outlined in the current Navy Installation Restoration (IR) Program are consistent with EPA guidance, and provide a structure for conducting an RI/FS based on the National Contingency Plan (NCP). This project entails the planning process for the second phase of the RI/FS investigation. The work plan for the RI is designed to characterize the nature and extent of contamination; verify the probable contaminant sources; and collect data to evaluate the need for remedial action(s). The RI sampling program is designed to meet all applicable guidance for Superfund, RCRA, and the Navy IR program.

The QAPP serves as a controlling mechanism during field sampling, sample laboratory analysis, and data validation to ensure all data collected are valid, reliable, and legally-defensible. The QAPP outlines the organization, objectives, and all Quality

Assurance/Quality Control (QA/QC) activities which will ensure achievement of desired data quality goals.

1.2 Location

The Naval Education and Training Center (NETC) is located within the Newport Naval Base, which encompasses approximately six miles of the western shore of Aquidneck Island, Newport County, Rhode Island. Aquidneck Island is comprised of three towns; Newport, Middletown, and Portsmouth. A map of the relative locations of NETC area is provided as Figure 1. NETC serves as a training facility and provides logistic support for the Newport Naval Base. NETC occupies approximately 1,063 acres of land.

1.3 History

Extensive information on the history of the Newport Naval Base was presented in the Initial Assessment Study (Envirodyne Engineers, 1983). Text from this report has been excerpted and referenced with appropriate page numbers below.

> "The Newport area was first used by the Navy during the Civil War when the Naval Academy was moved from Annapolis, Maryland to Newport in order to protect it from Confederate troops. The Naval Academy operated at Newport for about four years before returning to Annapolis.
>
> In 1869, the experimental Torpedo Station at Goat Island was established. This was the Navy's first permanent activity at Newport. The station was responsible for developing torpedoes and conducting experimental work on other forms of Naval ordnance.
>
> In 1881, Coasters Harbor Island was acquired by the Navy from the City of Newport and used for training purposes. In 1884, the Naval War College was established on the island. A causeway and bridge linking the island to the mainland was constructed in

1892. In 1894, the USS Constellation was permanently anchored as a training ship for the Naval War College.

The Melville area was established as a coaling station for the steam-powered ships in 1900. The Navy purchased 160 acres of land and constructed the Narragansett Bay Coal Depot. With the advent of ships burning liquid fuel, it became necessary to add oil tanks. Consequently, in 1910, four fuel oil tanks were added in the Melville area. These tanks are still used today.

In 1913, the Navy established the Naval Hospital on the mainland of Aquidneck Island. At this time the main hospital building was constructed.

The outbreak of Word War I caused a significant increase in military activity at Newport. Some 1,700 men were sent to Newport and housed in tents on Coddington Point and Coasters Harbor Island. A bridge was built at this time connecting Coddington Point with Coasters Harbor Island. In 1918, Coddington Point was purchased by the Navy. Much of the base organization was then transferred to Coddington Point. During the war, numerous destroyers and cruisers were fueled by the Melville Coal Depot and fuel tanks. By this time, a pipeline had been extended to the north fueling pier and two additional oil tanks constructed.

Following World War I, fuel oil gradually replaced the use of coal by the Navy fleet. In 1921, the Coal Depot was changed to the Navy Fuel Depot. In 1931, the coal barges and coaling equipment were sold to the highest bidder.

In 1923, some two hundred buildings, which were part of the emergency war camps established on Coddington Point, were stripped and sold for scrap. The base remained relatively inactive until the onset of World War II.

Reactivation of the base occurred in the late 1930's as a result of military build-up in Europe. Just prior to the reactivation, a 1938 hurricane and tidal wave had destroyed or severely damaged over 100 buildings and much of the sea walls. In 1940, Coddington Cove was acquired for use as a supply station, and hundreds of Quonset huts were constructed throughout the base. Additional barracks were constructed on Coasters Harbor Island, increasing the base housing capacity to over 3,500 men. Power plant facilities were also constructed at this time. Coddington Point was reactivated to house thousands of recruits. The Anchorage housing complex in the Coddington Cove area was constructed in 1942. In the Melville area, additional fuel facilities were constructed along with a Motor Torpedo Squadron Boat Training Center and nets for harbor defense. Tank Farms 1 through 5 were constructed during this time period. The Fire Fighting School, Fire Control Training Building, and the Steam Engineering Building were constructed in 1944.

The Torpedo Station at Goat Island was very active during World War II and had expanded its operation to Gould Island. The Torpedo Station employed more than 13,000 people and manufactured 80 percent of all torpedoes used by our country during the war. The station was the largest single industry ever operated in Rhode Island.

Following World War II, naval activities at Newport converted to a peace time status. This resulted in a reduction of naval activity. Some 300 Quonset huts and buildings were removed, and the entire naval complex was consolidated into a single naval command designated the U.S. Naval Base in 1946.

The Naval Base adjusted to its peace time status by increasing its activities in the fields of research and development, specialized training, and preparedness for modern warfare. There was a brief period during the Korean War when some 25,000 sailors trained at Newport.

In 1951, the Torpedo Station was permanently disestablished after 83 years of service. Future manufacture of torpedoes was to be awarded to private industry. In place of the Torpedo Station, a new research and development facility, the Naval Underwater Ordnance Station, was established and given the responsibility of overseeing the private contractors. The Officer Candidate School was also established in 1951.

In 1952, the Training Station and other naval schools were disestablished, and the U.S. Naval Station and the U.S. Naval Schools Command were established.

In 1955, Pier 1 was constructed, with Pier 2 being added in 1957. Newport became the headquarters of the Commander Cruiser-Destroyer Force Atlantic in 1962. Some 55 naval warships and auxiliary craft were homeported at Newport. New housing and bachelor quarters were added in the late 1950's and early 1960's.

Major expansion of the Naval War College occurred during the late 1950's and early 1970's, transforming the college into a major university. In July of 1971, The Naval Schools Command was restructured and named the Naval Officer Training Center (NOTC).

In April of 1973, the Shore Establishment Realignment Program (SER) was announced and resulted in the largest reorganization of Naval forces in the Newport Area. The fleet stationed in Newport was relocated to other naval stations on the east coast. SER resulted in the disestablishment of the Naval Communication Station and the Fleet Training Center and related activities. The Public Works Center, Naval Supply Center, Naval Station and Naval Base were absorbed by NOTC. In April of 1974, NOTC was changed to the Naval Education and Training Center (NETC).

The drastic changes which resulted from SER caused a reduction of Navy personnel, both military and civilian, in excess of 14,000. Coupled with the reductions at the

Naval Construction Battalion Center at Davisville, and the closure of the Naval Air Station at Quonset Point, SER had severe economic impacts in the Narragansett Bay area.

The reorganization brought about by SER resulted in the Navy excessing some 1,629 [1,374] acres of its 2,420 [2,805] acres. Some of the land has been leased to the State of Rhode Island pending final sale of the land by the General Services Administration.... The Navy also leases 44 acres of land in Coddington Cove to the State of Rhode Island and Economic Development Corporation. The state has subleased this property to a private enterprise engaging in shipbuilding and repair. Also, a fish food processing operation utilizes the cold storage warehouse in Building 42 near Pier 1.

The above information on the history of the installation was obtained from the most recent Master Plan (NORTHDIV, 1980), the 1981 Annual Report of the Navy in the Rhode Island Area (NETC Public Affairs Office, 1981), and the Command Histories at the Naval History Office in Washington, D.C."

(pp. 5-6 to 5-14)

1.4 Previous Site Investigations

The NETC facility has been under assessment through the Department of the Navy's Assessment and Control of Installation Pollutants (NACIP) program. The NACIP program was established to identify and control environmental contamination from past use and disposal of hazardous substances at Naval installations. The NACIP program is part of the Department of Defense Installation Restoration Program, which is similar to the U.S. EPA's Superfund program authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

The NACIP program consists of three phases: Phase I - Initial Assessment Study (IAS), Phase II - Confirmation Study (CS), and Phase III - Remedial Measures phase.

The IAS (Envirodyne Engineers, 1983) identified areas where potential contamination from past waste storage, handling, or disposal practices may pose threats to human health or the environment. Eighteen potentially contaminated areas were identified in the IAS report. Two of the areas were subsequently found to be outside of the scope of the NACIP program and were not discussed further in the report. The IAS concluded that no further action was required at three of the areas. Further investigation was recommended at the remaining thirteen areas.

A Confirmation Study was conducted at six of the thirteen areas recommended for further investigation. Table 1 provides a summary of the IAS recommendations for further study, at the sixteen sites reviewed. Three of the four RI sites were investigated under a Confirmation Study.

Confirmation studies were conducted for three of the five RI sites. The Confirmation Studies (Loureiro Engineering, 1986) conducted at McAllister Point Landfill, Tank Farm Four, and Melville North Landfill consisted of two steps: a Verification Step and a Characterization Step. The objectives of the Verification Step were to locate sources of contamination, determine the presence of specific toxic and hazardous materials, and determine general site hydrogeology. The objective of the Characterization Step was to develop a quantitative assessment of the contamination identified in the Verification Step.

Under the IR Program, Phase I Remedial Investigations (RI) have been conducted at five of the IAS sites on the NETC. The findings of the Phase I RI are presented in a draft RI report (TRC-EC, 1991).

1.5 Current Site Investigations

A Phase II Remedial Investigation will be conducted at the Melville North Landfill site. The planned Phase II RI field activities for this non-NPL site are presented in Volume III of this Work Plan.

1.6 Project Scope

An objective of this Remedial Investigation program is to gather sufficient information on the nature and extent of contamination at each site. The results of the Remedial Investigations should enable a technically-supported judgement as to whether specific site conditions constitute environmental, health or safety hazards.

The field activities and the associated sample matrices analyses for this site investigation will be discussed in this Work Plan. The sample program makes extensive use of Target Compound List (TCL) and Target Analyte List (TAL) analyses using EPA-CLP protocols, as defined in the USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis; Multi-Media, Multi-Concentration; SOW No. 3/90; revised July 1991, and in the USEPA CLP SOW for Inorganic Analysis; Multi-Media, Multi-Concentration; SOW No. 3/90; revised September 1991. These EPA CLP requirements will be followed during this study. Naval Energy and Environmental Support Activity (NEESA) guidance (Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, NEESA 20.2-047B, 1988) for Level D analyses and data validation will also be followed by the laboratory and data validator. Where EPA-CLP protocols and NEESA guidance differ, the more stringent requirements will be followed.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 Introduction

This project will be largely performed by TRC-EC. Project review will be performed by a Technical Review Committee assembled by the Northern Division. The names and addresses of select individuals involved in the project review and oversight appear below.

U.S. Navy

- Northern Division Code 1823
  Naval Facilities Engineering Command
  10 Industrial Highway, Mail Stop #82
  Lester, PA 19113

  Mr. Francisco LaGreca, Engineer-In-Charge
  (215) 595-0567

- Naval Education and Training Center
  Public Works Dept., Bldg. 1
  Newport, RI

  Ms. Rachel Marino
  (401) 841-3735

TRC-EC

- 5 Waterside Crossing
  Windsor, CT 06095

  Mr. Robert C. Smith, P.E., Program Manager
  Mr. James Peronto, Project Manager
  (203) 289-8631

Rhode Island DEM

- Air and Hazardous Materials Division
  291 Promenade Street
  Providence, RI 02908

  Mr. Paul Kulpa
  (401) 277-2797

U.S. EPA

- Region I
  Federal Facilities Section
  90 Canal Street, 2nd Floor
  Boston, MA 02203

  Ms. Carol Keating, Remedial Project Manager
  (617) 573-5769

Figure 1 presents the organizational chart for the NETC - Newport RI/FS project showing staff positions responsible for each project element. The responsibilities of TRC-EC's Project Manager and QA/QC staff are briefly described below.

2.2 Project Manager's Responsibility

The TRC-EC Project Manager will provide overall direction to the project team, and will be held responsible for successful project completion. The Project Manager will be the primary contact for the Northern Division's Engineer-In-Charge (EIC).

2.3 QA Manager's Responsibility

TRC-EC's Corporate QA Manager will be the responsible Quality Assurance Officer for this project. The QA Manager reports independently to the Corporate President and, hence, has full authority to act independently from the technical line management structure. He will serve as

TRC-EC's primary contact with the Northern Division's QA staff, if so requested by the EIC. He will monitor compliance of the project with the QAPP plan, and perform any necessary performance or system audits.

The TRC-EC QA Manager will initiate and monitor any necessary formal corrective actions. He will assist in preparing QA/QC project summaries for the RI Report, including analysis of precision, accuracy, and completeness of data collected.

2.4 Field QC Coordinator's Responsibilities

A Field QC Coordinator will be selected for this project. The Field QC Coordinator will work with the field team in preparing for the sampling events, and also during the field work. He or she will be on site to ensure required QC procedures are followed for sample collection and handling; will initiate informal and/or formal corrective actions, as necessary; and will maintain and report QC records and results to the TRC-EC Project Manager and QA Officer. The QC field coordinator will also serve as the QA/QC Manager for the project. This person will be responsible for ensuring all analytical deliverables have been received and subsequently validated in accordance with this QAPP.

2.5 Laboratory QC Coordinator

The analytical laboratory selected for this project, a NEESA-approved and EPA CLP laboratory, will also designate a QC Coordinator who will function as part of the project QC team. The duties of the laboratory QC Coordinator or designee will include, at a minimum, the following:

- Direct preparation of sample containers;
- Direct preparation and inclusion of blind QC samples in sample load in a fashion unrecognizable to analysts;
- Monitor use of known QC samples, blanks and duplicates, as required by specific projects;

Maintain records of performance on known and blind QC samples as a measure of analytical precision and accuracy (control charts, etc.); and

Direct and monitor recordkeeping and sample tracking activities.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

3.1 Introduction

The overall quality assurance objective for laboratory analysis of environmental samples is to provide a laboratory QA/QC program that is, at a minimum, equal to the U.S. EPA Contract Laboratory Program (CLP). The quality control limits of accuracy and precision for laboratory analyses are governed by the methods and equipment used. Laboratory QA/QC requirements defined in CLP protocol are designed to ensure that acceptable levels of data accuracy and precision are maintained throughout the analytical program. These requirements are detailed in the U.S. EPA CLP Statement of Work (SOW) for Organic Analysis; Multi-Media, Multi-Concentration; SOW No. 3/90; revised August 1991 and in the U.S. EPA CLP SOW for Inorganic Analysis; Multi-Media, Multi-Concentration; SOW No. 3/90; March 1990. These requirements will be followed during this study. In addition, Navy NEESA Level D analysis requirements will be followed when more stringent.

It must be recognized that QA objectives may be attainable only for samples that are homogeneous and do not have inherent matrix-related problems. In the event that QA objectives cannot be met on specific samples, groups of samples or sample types, the analytical laboratory will make every reasonable effort to determine the cause of non-attainment and, if such is due to instrument malfunction, operator error, or other identifiable cause within the control of the laboratory, the samples affected will be reanalyzed, if possible. Should non-attainment of QA objectives be due to sample inhomogeneity, sample matrix interference, or other sample-related causes, reanalyses will be treated as additional analyses.

For many EPA-approved methods, interlaboratory method verification studies have been used to establish QC criteria which may be regarded as an inherent part of the method. In those cases, such criteria will take precedence except for deviations from such criteria that can be reasonably attributed to sample-related cases.

The quality assurance objectives for all measurement data include considerations of precision, accuracy, completeness, representativeness, and comparability as described below.

3.2 Precision and Accuracy

The precision of a measurement is an expression of mutual agreement of multiple measurement values of the same property conducted under prescribed similar conditions. Precision reflects the repeatability of the measurement. Precision is evaluated most directly by recording and comparing multiple measurements of the same parameter on the same sample under the same conditions. Precision is usually expressed in terms of the standard deviation. The precision objectives for analytical parameters are specified in the CLP protocols. Except as otherwise specified by the method, the QC objective for precision under this project will be ± 20 percent (relative percent difference) as determined by duplicate analyses. It must be recognized that for analytes at concentrations of less than five times the method detection limit (MDL), this objective is unlikely to be met.

The degree of accuracy of a measurement is based on a comparison of the measured value with an accepted reference or true value, or is a measure of system bias. Accuracy of an analytical procedure is best determined based on analysis of a known or "spiked" sample quantity. The degree of accuracy and the recovery of analyte to be expected for the analysis of QA samples and spiked samples is dependent upon the matrix, method of analysis, and compound or element being determined. The concentration of the analyte relative to the detection limit is also a major factor in determining the accuracy of the measurement. Except as otherwise specified by a method, the QC objective for accuracy under this project will be 75 to 125 percent (percent recovery), as determined by sample spike recoveries. Alternately, accuracy may be assessed through the analyses of appropriate standard reference materials, certified standards, or samples, as available.

3.3 Completeness

Completeness is a measure of the amount of valid data obtained from the measurement system relative to the amount anticipated under ideal conditions. This project's QC objective for completeness, as determined by the percentage of valid data generated, will be ≥ 90 percent.

3.4 Representativeness

Samples taken must be representative of the population. Where appropriate, the population will be statistically characterized to express: 1) the degree to which the data accurately and precisely represent a characteristic of a population, 2) parameter variations at a sampling point, and 3) a process, or an environmental condition. Sample selection and handling procedures will be conducted to obtain the most representative sample possible. Sampling devices will be decontaminated between sampling points to ensure that cross-contamination does not occur between samples.

Representativeness will also be monitored by collection and analysis of the following QC field samples:

- Trip blanks;
- Field blanks;
- Source water blanks; and
- Duplicate samples.

These QC samples will be collected in accordance with Section 4.4 of the QAPP.

Representative samples will be collected through the following actions:

- Collect samples from locations fully representing the site conditions;
- Use appropriate sampling procedures and equipment;
- Use appropriate analytical methodologies; and
- Analyze for appropriate parameters using appropriate detection limits.

Field duplicate and field blank samples will be shipped as blind samples to the laboratory. These samples will be numbered similarly to other samples except fictitious sample identifiers will be assigned. Trip blanks will be labelled as such and shipped with samples being analyzed for volatile organics. Samples for matrix spike and matrix spike duplicates will be designated on the chain-of-custody forms and sample labels. Water samples for matrix spike and matrix spike duplicate analyses for organic parameters will be collected in triplicate; samples for matrix spike analyses for inorganic parameters will be collected in duplicate.

The laboratory will make appropriate efforts to assure that the samples are adequately homogenized prior to taking aliquots for analysis, so reported results represent samples received. Some techniques of homogenization (e.g., compositing) expose the sample to significant risk of contamination or loss through volatilization, and will be avoided.

3.5 Comparability

Consistency in sample acquisition, handling, analysis and level of QA/QC is necessary so that the analytical results may be compared. Where appropriate, the results of the analyses will be compared with the results obtained in previous studies. The laboratory will also use EPA-approved methods and reporting units, in order to assure that the data will be comparable to other similarly generated data sets.

4.0 SAMPLING PROCEDURES

4.1 Introduction

The following matrices will be sampled during the Phase II field investigation study at NETC - Newport: soil and ground water. All sample collection and monitoring methodology are presented in Appendix B of Volume III of this Work Plan. These procedures will be implemented in order to collect representative data for remedial planning guidance. All sample media collected will be handled in accordance with this Quality Assurance Project Plan and the Field Sampling Plan. All analytical methods and estimated detection limits are subsequently described in Section 7.0 of this document, including analysis for the Target Compound List (TCL) and Target Analyte List (TAL), as well as all other parameters for this project.

4.2 Selection of Sampling Locations

The sample locations for the Phase II RI at the Melville North Landfill site are presented in the Field Sampling Plan in Volume III of this Work Plan.

4.3 Sample Collection, Handling, and Shipping

It is important to use appropriate sample containers so that no chemical alteration occurs between the collection of samples in the field, and the receipt of samples at the laboratory. The sample bottles will be prepared and shipped to the field by the laboratory, under the direction of the laboratory QC coordinator. The sample bottles will be transported to the site within a sealed shipping cooler.

Sample containers will be selected to ensure compatibility with the potential contaminants and to minimize breakage during transportation. Aqueous phase samples for organic analyses will be contained in glass vials with teflon-lined, screw-type caps. Sample bottles, analytical methods and preservation required are listed in Table 1 for soil samples and in Table 2 for aqueous samples. Holding times are further defined in Table 3, for the analytical methods listed in Tables 1 and 2.

Sample labels will be filled out at the time of sampling and will be affixed to each container to identify the sample number, collector's name, date and time of collection, location of the sampling point, preservatives added, and analyses requested for the sample.

Ground water samples collected from all wells will be analyzed for total metals and consequently, filtering will not be conducted in the field prior to the addition of preservatives. Water samples to be analyzed for cyanide will be checked in the field for the presence of chlorine using potassium iodide (KI) starch paper. If chlorine is present, ascorbic acid will be added until the KI paper indicates that no chlorine is present.

After the bottles for a given sample site have been filled, they will be placed in a shipping cooler. Field personnel will add bags of crushed ice or ice packs to the shipping coolers as the samples are collected. Each sample container will be cushioned with packing materials and sealed in a refrigerated cooler container for shipment to the laboratory by overnight delivery. Daily sample collection activities will be scheduled in order to assure overnight delivery of samples.

A chain-of-custody record will be prepared and will accompany all samples to provide documentation of all samples collected and to trace sample possession. Chain-of-custody procedures are discussed in detail in Section 5 of this document.

4.4 Field Quality Control (QC) Samples

Table 4 lists the percentage of field QC samples per sample matrix for the Level C analyses, based on current Navy (NEESA) guidance. A sampling event is defined as the time from which the sampling personnel arrive at the site until these personnel complete the sampling task. An example of two events would occur if sampling personnel went to a site for 3 weeks, drilled borings, and installed ground water monitoring wells. During this task, soil and water samples were collected for laboratory analysis. The sampling crew subsequently left the site for two months, thus concluding the first sampling event. The crew later returned to collect another set of ground water samples over a 3-day period. The second visit would constitute the second sampling event.

Trip blanks, field blanks, and duplicate samples will be collected as part of each sampling event, in order to ascertain a measure of quality control during each sampling round. The following sections describe the purpose and usage of each of these types of samples.

4.4.1 Trip Blanks

Trip blanks are defined as samples which originate as analyte-free water which is placed in volatile organic vials and preserved with HCl in the laboratory and shipped to the site in the sample cooler with sample containers. These vials are subsequently returned to the laboratory with samples for volatile organics analysis (VOA). One trip blank will accompany each cooler containing samples to be analyzed for VOAs, and will be stored at the laboratory with the samples. Trip blanks will be analyzed in order to evaluate the effect of ambient site conditions and sample shipment on sample integrity, and to ensure proper sample container preparation and handling techniques. All trip blanks will be labeled according to the proper chain-of-custody procedures and will be analyzed for volatile organic compounds.

4.4.2 Field Blanks

Field blanks will be collected in order to determine the effectiveness of the decontamination of sample collection equipment. The field blank will be collected by pouring laboratory-supplied, analyte-free deionized water for inorganic fraction analyses and HPLC-grade water for organic fraction analyses over the decontaminated sample collection equipment (i.e., bailer, stainless steel spoon, etc.) and into the appropriate sample containers. Field blanks will be collected for each matrix sampled. All field blanks will be analyzed for the same analytical parameters as the sample matrix. A minimum of one field blank will be collected for every 20 samples or per day per matrix, whichever is greater. All field blanks will be preserved in accordance with the methods specified in Table 2, labeled according to the proper chain-of-custody procedures, and stored and shipped according to the procedures discussed previously.

4.4.3 <u>Source Water Blanks</u>

Source water blanks consist of the source water (obtained from NETC-Newport water supply) used for decontamination (e.g., steam cleaning). At a minimum, one source blank from each source of water will be collected and analyzed for the same parameters as the related samples. In addition, samples of the distilled water used in sampling equipment decontamination will also be analyzed for the full TCL/TAL.

4.4.4 <u>Field Duplicates</u>

Duplicate samples will be collected, homogenized, and split. The procedure for collecting duplicate samples consists of alternating the collection of the sample between the sample collection bottle and the duplicate collection bottle. Samples for volatile organic compound analyses will not be mixed, but equal portions of the sample will be collected simultaneously and placed in 40-ml glass vials. Field duplicates will be collected at a frequency of 10 percent per sample matrix (NEESA - Level D). All duplicate samples will be sent as "blind" (unknown duplicate samples) to the primary laboratory responsible for the sample analysis.

4.4.5. <u>Regulatory Splits</u>

If regulatory agencies (state or federal) wish to obtain samples for independent analysis which are duplicates of those collected by TRC-EC, these regulatory split samples will be collected in the same manner as field duplicates. However, these splits will be sent by the regulatory agency to a separate, independent laboratory for analysis.

4.5 <u>Field Decontamination Procedures</u>

Drill rigs, backhoes, and drilling equipment will be decontaminated prior to moving to a site. Drilling equipment used for multiple boreholes will be decontaminated prior to each use. All decontamination of drill rigs and drilling equipment (e.g., augers, rods) will be conducted at designated decontamination areas with a steam cleaner. Decontamination of sampling equipment will be performed at designated decontamination areas. Sampling equipment such as split-spoons, stainless steel spoons or spatulas, and stainless steel mixing bowls will be decontaminated using the following procedures:

- Wash and scrub with low phosphate detergent in tap water;
- Rinse with tap water;
- Rinse with 10% nitric acid (1% nitric acid on carbon steel split-spoons);
- Rinse with tap water;
- Rinse with hexane and methanol - pesticide grade solvents or better;
- Rinse with distilled water (demonstrated to be analyte-free);
- Air dry - on clean polyethlyene sheeting; and
- Wrap in aluminum foil, shiny side out for transport (if not being used immediately).

NOTE: Clean equipment may rest on -- but never be wrapped in clean polyethylene sheeting.

An attempt will be made to coordinate a drilling sequence hierarchy from less likely to more likely contaminated boring locations to reduce the potential for cross-contamination between locations. All sampling equipment will be decontaminated prior to use at each sampling location.

All decontamination rinsates will be collected and contained in drums for subsequent determination of proper handling and/or disposal.

5.0 SAMPLE CUSTODY

5.1 Introduction

Sample custody procedures will be observed to ensure the validity of the data generated during this program. Sample chain-of-custody will be initiated with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling samples will be restricted, and one person will be assigned the responsibility of field sample custodian.

On-site monitoring data will be controlled and entered daily in permanent log books, as appropriate. Personnel involved with the sample chain-of-custody process will be trained in sample collection and handling procedures prior to project initiation.

5.2 Field Sample Custody

Sample custody and documentation procedures described in this section will be followed throughout all sample collection activities at NETC-Newport. Components of sample custody procedures include the use of field notebooks, sample labels, and chain-of-custody forms.

5.2.1 Field Notebooks

The TRC-EC project manager will oversee the maintenance of all field notebooks. Field notebooks will be bound books, preferably with consecutively numbered pages, that are at least 4 inches x 7 inches in size. Field notebooks will be maintained by the TRC-EC field team leader and other team members to provide a daily record of significant events, observations, and measurements during the field investigation activities. All notebook entries will be signed and dated.

All information pertinent to the field survey and/or sampling will be recorded in the notebooks. Field notebook entries will include the following information (at a minimum):

- Name and address of field contact;
- Name and title of author, date and time of entry, and physical/ environmental conditions during field activity;
- Names of field crew;
- Names and titles of any site visitors;
- Type of sampling activity;
- Location of sampling activity;

Description of sampling point(s);
Date and time of sample collection;

- Sample media (e.g., soil, sediment, ground water, etc.);
- Sample collection method;
- Number and volume of sample(s) taken;
- Analyses to be performed;
- Sample preservatives;
- Sample identification number(s);
- Field observations;
- Any field measurements made such as pH, temperature, conductivity, water level, etc.;
- References for all maps and photographs of the sampling site(s); and

All original data recorded in either the field notebooks, on sample labels, or in the chain-of-custody records will be written with waterproof ink. None of these accountable, serialized documents will be destroyed or discarded, even if they are illegible or contain inaccuracies.

If an error is made on an accountable document assigned to an individual, that individual will make all corrections by crossing a line through the error and entering the correct information and initialing the cross-out. The erroneous information will not be obliterated. Any subsequent error discovered on an accountable document will be corrected by the person who made the entry, and will be initialed and dated, as appropriate.

5.2.2 Sample Labels

All samples obtained at the site will be placed in an appropriate sample container for preservation prior to shipment to the laboratory. Each sample will be individually identified with a separate identification label recorded with a unique sample identifier. The information recorded on the label will include:

- Project name/project number/location;
- Sample identifier/number;
- Analysis to be performed;
- Preservatives used, especially any non-standard types, and any other field preparation of the sample;
- Date of collection;
- Time of collection (a four-digit number indicating the 24-hour (military) clock time of collection; e.g., 1430 for 2:30 p.m.);
- Number of containers per analyte (i.e., 1 of 2, etc.); and
- Sampler's initials.

Examples of TRC-EC's proposed sample identification labeling format for each sample type are presented in Appendix B of the project Field Sampling Plan.

5.2.3 Custody Seals

Samples will be placed in sample coolers and the coolers will be sealed with custody seals prior to shipment to the laboratory. Clear adhesive tape will be placed over the seals to ensure that seals are not accidentally broken during shipment.

5.2.4 Chain-of-Custody Records

All samples will be accompanied by a chain-of-custody record, an example of which is shown on Figure 2. A chain-of-custody record will accompany the sample from initial sample container selection and preparation commencing at the laboratory, to the field for sample containment and preservation, and through its return to the laboratory. If samples are split and sent to different laboratories, a copy of the chain-of-custody record will be sent with each sample.

The "Remarks" column in the chain-of-custody record will be used to record specific considerations associated with sample acquisition such as: sample type, container type, and sample preservation methods. When transferring samples, the individuals relinquishing and assuming sample custody will sign, date, and note the transfer time on the record.

A minimum of two copies of the chain-of-custody record will follow each sample to the laboratory. The laboratory will maintain one file copy, and the completed original will be returned to the TRC-EC Project Manager. A copy of the completed original will be returned as a part of the final analytical report. This record will be used to document sample custody transfer from the sampler, to another TRC-EC team member, to a shipper, or to the laboratory, and also to verify the date of sample receipt in the laboratory.

Shipments will be sent by overnight carrier with appropriate bill of lading documentation. Bills of lading will be retained as part of the permanent program documentation.

5.2.5 Sample Shipment

Samples will be delivered to the laboratory for analysis as soon as practical after the number of samples and sample containers is sufficient to comprise a shipment, preferably the same day the samples are collected. Sample shipment will occur at a minimum frequency of every other day. All samples will be stored in coolers at a temperature of 4°C. The samples will be accompanied by the chain-of-custody record. During sampling and sample shipment activities, the TRC-EC field team leader (or his designee) will contact the laboratory daily to provide information about impending shipments.

5.2.6 Sample Master Log Notebook

In addition to the field notebook documentation, all samples will be documented in a master sample log notebook for future reference. This master sample log will include the following information: sample identifier, sampling date and time (military), sampling personnel, matrix type (i.e., soil), containers/parameters for analysis, date and method of shipment, any sample preservation, and any other pertinent information relating to the sample(s). The master sample log will be consistently updated during sampling activities in the field for review during field audits. Upon completion of sampling activities, the master sample log notebook will be delivered to the TRC-EC Project Manager.

5.3 Laboratory Sample Custody

The TRC-EC Field QC Coordinator will notify the laboratory of upcoming field sampling activities and subsequent sample transfer to the laboratory. This notification will include information concerning the number and type of samples to be shipped, as well as the anticipated sample arrival date.

The laboratory will designate a sample custodian who will be responsible for maintaining sample custody and for maintaining all associated custodial documentation records. After receiving the samples, the sample custodian will check the original chain-of-custody record and request for analysis documents against the labeled contents of each sample container for correctness and traceability. The sample custodian will then sign the chain-of-custody record and record the date and time that the sample shipment was received at the laboratory. The samples will then be logged into the laboratory system.

Care will be exercised in the laboratory to annotate any labeling or descriptive errors associated with the sample containers. In the event of discrepant documentation, the laboratory will immediately contact the TRC-EC Field QC Coordinator as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.

Samples will be stored in a secured dark area and at a temperature of approximately 4°C, if necessary, until analyses are performed. A laboratory chain-of-custody record will accompany the sample or sample fraction through final analysis for sample control. A copy of the chain-of-custody record will accompany the laboratory's analytical report and will become a permanent part of the project's records. The pH of incoming water samples will be checked by the laboratory when preservatives have been added to the sample. Details of the chain-of-custody for laboratory activities will be provided in the laboratory's QA manual.

5.4 Evidence File

The TRC-EC Project Manager will serve as file custodian. At the project's completion, the files will be returned to the Navy's Northern Division Office where they will be permanently archived.

The evidence file will contain all incoming materials related to the project such as: sketches, correspondence, authorizations, and logs. These documents will be placed in the project file as soon as possible. If correspondence is needed for reference by project personnel, a copy will be made rather than manipulating the original. All records shall be legible and easily identifiable.

Examples of the types of records that will be maintained in the project file are:

- Field documents;
- Correspondence;
- Photographs;
- Laboratory data;
- Reports; and
- Subcontract agreements.

Out-going project correspondence and reports will be reviewed by the Project Manager or designee prior to mailing.

To prevent the inadvertent use of obsolete or superseded project-related procedures, all personnel of the laboratory and project staffs will be responsible for reporting changes in protocol to the Laboratory Project Manager and the Laboratory Director. The Laboratory Project Manager and Laboratory Director will then inform the project and laboratory staffs and the Quality Assurance Officer of these changes, as appropriate.

Revisions to procedures shall be subject to the same level of review and approval as the original document. Outdated procedures shall be marked "void". The voided document may be destroyed at the request of the Laboratory Project Manager; however, it is recommended that one copy of the voided document be maintained in the project file. The date and reason why the document was voided will be recorded.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the instrument manufacturer's specifications.

Laboratory instrumentation calibration procedures and frequencies are specified in the Contract Laboratory Program (CLP) Statement of Work (SOW), for Organic Analysis; Multi-Media, Multi-Concentration; SOW No. 3/90; revised July 1991 and in the CLP SOW for Inorganic Analysis; Multi-Media, Multi-Concentration; SOW No. 3/90; September 1991, and will be strictly followed for those analytes analyzed by CLP protocols. For all other analyses for which EPA-approved methods exist, the laboratory will employ such methods and follow the specified calibration procedures and frequencies. The laboratory quality control program includes strict adherence to routine calibration procedures. A description of calibration procedures and frequencies for non-CLP methods will be provided by the laboratory selected for this program.

Analysis of blank samples, duplicate samples, spiked blanks, and matrix blanks will be performed where possible to document the effectiveness of calibration procedures. Method blanks contain all the reagents used in the preparation and analysis of the samples and are processed through the entire analytical scheme to assess spurious contamination from reagents, glassware and other materials used during analysis. The terms method blank and laboratory blank are interchangeable. A matrix blank denotes a blank of a similar matrix (e.g., for liquids a blank of distilled-deionized reagent grade high purity water may be used; for soils/sediments high purity sand may be used). A spike blank is a method blank which has had a known concentration of a particular compound or analyte added to it to assure adequate percent recovery of the compound/analyte.

Records of calibration, repair, or replacement will be maintained by the designated laboratory personnel performing quality control activities. Calibration records of assigned laboratories will be filed and maintained at the laboratory location where the work is performed and subject to QA audit.

Calibration of field instruments will be performed at approved intervals as specified by the manufacturer or more frequently, as conditions dictate. At a minimum all field instruments will be calibrated at the beginning and end of each day. Calibrations may also be performed at the start and completion of each test run; however, such calibrations will be re-initiated as a result of delay due to meals, work shift change, or instrument damage. Calibration standards used as reference standards will be traceable to the National Bureau of Standards (NBS), when possible. Calibration procedures for field instruments will be as specified by the instrument manufacturer. Equipment manuals describing calibration procedures will be maintained in the field office during site investigations.

7.0 ANALYTICAL PROCEDURES

7.1 Introduction

EPA-approved methods will be used for all analyses for which such methods exist. Target Compound List (TCL) and Target Analyte List (TAL) parameters will be analyzed by Contract Laboratory Program (CLP) protocols. The laboratory will follow methods detailed in the CLP Statement of Work (SOW) for Organic Analyses, Multi-media, Multi-concentration, 3/90, revised July 1991, and the SOW for Inorganics Analyses, Multi-media, Multi-concentration, 3/90, revised September, 1991. US Navy NEESA guidance for Level D analyses will also be adhered to by the laboratory when more stringent than the CLP requirements.

If sample contaminant concentrations are high, then CLP protocols for low and medium concentration samples may be required. In this case, sample runs at lower dilutions will be performed to obtain quantitative results for parameters present at lower concentrations. That is, samples are pre-screened to estimate concentration levels. According to EPA methodology, high concentration samples are diluted to bring them within a linear working range. Low concentration samples are set aside and then analyzed within the same linear working range. It may not be possible to quantitate sample results in parts per billion for samples where "pure" waste (fuel product, paint, powder, etc.) is encountered. A decision tree approach will be followed, in order to quantitate the sample when high levels of contamination are encountered. In this case, detection limits will be raised for all analytes on the sample, as the sample is diluted.

7.2 Target Compound List - Organic Compounds

All organic compound analyses will be conducted according to the U.S. EPA CLP, Statement of Work for Organic Analyses, SOW 3/90, revised August 1991. The organic compounds contained in the TCL will be determined using proven methods to identify and quantify volatile, semi-volatile and pesticide/PCB compounds. The TCL compounds and CLP-required detection limits are shown in Tables 5 through 7. The actual detection limits obtainable for a specific sample depend upon matrix interferences. If the CLP detection limit is unachievable for a particular sample, an explanation of the problem and supporting evidence will be provided by the laboratory in the case narrative summary submitted with the deliverables.

Each set of samples will be analyzed in conjunction with the analysis of QC samples, including field duplicates, blanks, matrix spikes and matrix spike duplicate (MS/MSD) samples for quality control determinations. The frequency of analysis of the QC samples, as previously presented in Section 4.4, will not be less than one per 20 samples and at least one per sampling day for field blanks, not less than one per 10 samples for field duplicates, and not less than one per 20 samples for MS/MSD samples (see Table 2). All samples, field duplicates, blanks, matrix spike and matrix spike duplicates will be fortified with surrogate spiking compounds as shown in Table 8. The CLP recommended guidelines for percentage recovery of the surrogate compounds are provided in Table 9. The percentage recovery of the matrix spiking compounds and relative percentage difference of duplicate analyses will be calculated to obtain measurements of the analyses accuracy and precision.

7.3 Target Analyte List - Metals

All water and soil samples will be prepared for analyses as described by procedures for each respective matrix and analysis method described in the U.S. EPA CLP, Statement of Work for Inorganic Analyses (SOW 3/90). Each set of samples, or 20 samples, whichever is more frequent, will be analyzed with a preparation blank, duplicate sample, and matrix spiked sample. Each group of 20 samples will be analyzed with a laboratory control sample of similar matrix. The Target Analyte List (TAL) for metals and inorganics and associated detection limits are listed in Table 10.

The atomic absorption (AA) instrument will be calibrated through the use of a minimum of three calibration standards prepared by dilution of certified stock solutions. Calibration standards will contain acid(s) at the same concentration as the digestates. An analysis blank will then be prepared, and one calibration standard will be at the EPA-CLP required detection limit for the metal being evaluated. The other standard concentrations will bracket the concentration range of the samples. A continuing calibration standard, prepared from a different stock solution than that used for the calibration standards, will be prepared and analyzed after every ten samples or every two hours of continuous instrument operation. The value of the continuing calibration standard concentration must agree with requirements of the CLP SOW.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

o.1 Introduction

The procedures used for calculations and data reduction are specified in each analytical method referenced in Section 7.0 of this document. Raw data will be entered in bound laboratory notebooks. A separate book will be maintained for each analytical procedure. The data will be entered such that sufficient space remains to enter all subsequent calculations required to arrive at the final (reported) value for each sample. Calculations include factors such as sample dilution ratios, corrections for titrant normality, and conversion to dry-weight basis for solid samples. Instrument chart recordings and calculator printouts will be labeled and attached to their respective pages, except for voluminous gas chromatograms which will be cross-referenced and stored separately.

Calculations will be checked from the raw data to final value stages prior to reporting the results for a group of samples. Results obtained from extreme ends of standard curves generated by linear regression calculator programs will be checked against graphically-produced standard curves if the correlation coefficient of a program curve is less than 0.995.

Data will generally be reported as micrograms of analyte per liter for aqueous samples or micrograms per kilogram (dry weight) for solid or non-aqueous liquid samples. Concentration units will always be listed on reports and any special conditions, such as dry weight conversions, will be noted. The data reporting form will also include the unique sample number assigned to each sample, details of sample collection including the client's identification number, and the dates of sample receipt and report preparation.

8.2 Data Reduction

8.2.1 Target Compound List Compounds

Instrument performance test data will accompany the raw data during data reduction. The following criteria must be attained to make a qualitative identification of an organic pollutant using Gas Chromatograph/Mass Spectrometer (GC/MS) techniques:

Characteristic ions for each compound of interest must maximize in the same or within one scan of each other.

Retention time must occur within ± 1 percent of the retention time of the authentic compound.

Relative peak heights of the three characteristic ions in the Extracted Ion Current Profile (EICP) must fall within $\pm$ 20 percent of the relative intensities of these ions in a reference mass spectrum. The reference mass spectrum can be obtained by a standard analyzed in the GC/MS system or from a reference library.

The entire mass spectrum of the compound of interest is compared to the reference compound.

Structural isomers having similar mass spectra can be explicitly identified only if the resolution between authentic isomers in a standard mix is acceptable. Acceptable resolution is achieved if the baseline-to-valley height between the isomers is less than 25 percent of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

When a compound has been identified, the quantitation of that compound is based on the integrated abundance from the EICP of the primary characteristic ion. The base peak ion of internal and surrogate standards is used in the quantitation. If the sample produces an interference for the first listed ion, a secondary ion is used to quantitate. Quantification is performed using internal standard techniques.

To ensure that reported data are accurate, all resultant data are verified. Retention items and area counts are checked carefully for correct identification and accurate quantification.

8.2.2 Metals and Cyanide

The concentrations of metals determined by Atomic Absorption Spectroscopy (AAS) measurements are obtained by comparison of absorbance values with those obtained from the analyses of known standards. A linear regression plot of absorbance versus concentration will be used to determine a concentration factor for linearity of response.

In the event of low (<85%) or high (>115%) post-digestion spike recovery, the analysis will be repeated using the method of known additions to determine potential matrix interferences. CLP criteria will be maintained for analyses of samples of similar matrix. The mean percentage recovery and standard deviation will be calculated from a minimum of 20 analyses. A warning limit of ± 2 standard deviations from the mean and a control limit of ± 3 standard deviations will be used to establish that the test is providing accurate data.

8.3 Data Validation

Data validation is the process of reviewing data and associated quality control criteria and accepting, qualifying, or rejecting it on the basis of sound criteria. Project supervisory and QC personnel will use validation methods and criteria appropriate to the type of data and the purpose of the measurement. Records of all data will be maintained, even that judged to be an "outlying" or anomalous value. The QA/QC Manager validating the data will have sufficient knowledge of the technical work to identify questionable values.

8.3.1 Field Data Validation

Field sampling data will be validated by the TRC-EC Field QC Coordinator or QA/QC Manager, based on their judgment of the representativeness of the sample, maintenance and cleanliness of sampling equipment, and adherence to the approved, written sample collection procedure.

The following criteria will be used to evaluate the field sampling data:

- Use of approved sampling procedures;
- Use of reagents/standards that conform to QC-specified criteria; and
- Proper chain-of-custody maintained and documented.

8.3.2 Analytical Data Validation

Analytical data validation will include validation procedures within the laboratory and independent of the laboratory.

Data from laboratory analyses will be validated by the Laboratory QC Coordinator using criteria outlined below. Results from field and laboratory method blanks, replicate samples, equipment rinsates and internal QC samples will be used to validate analytical results.

The criteria listed below will be used to evaluate the analytical data:

- Use of approved analytical procedures;
- Use of properly operating and calibrated instrumentation;
- Acceptable results from analyses of laboratory control samples (i.e., the reported values should fall within the 95 percent confidence interval for these samples); and
- Precision and accuracy for this project should be comparable to that achieved in previous analytical programs and consistent with objectives stated in Section 7 of this QAPP.

Independent of the analytical laboratory, analytical data validation will be conducted which will follow the most stringent of the requirements and protocols specified in the following documents:

U.S. EPA, "Region I Laboratory Data Validation: Functional Guidelines for Evaluating Organic Analyses", February 1988; modified November 1988;

U.S. EPA, "Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses", June 1988, modified February 1989;

U.S. EPA, Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, 3/90, revised August 1991;

U.S. EPA, Contract Laboratory Program, Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, 3/90, revised September 1991; and

U.S. Navy/NEESA, Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (NEESA 20.2-047B), June 1988.

All of the Phase II RI data will be validated in accordance with these requirements.

The data validation activities focus on areas of the analytical process which are under the laboratory's control when analyzing samples. The data qualifiers which result from validation represent the QC areas under the laboratory's control which could have been improved. Qualifiers attached to the data during validation supersede the qualifiers assigned by the laboratory.

Areas reviewed in the validation of organic data include the following: sample holding times, gas chromatography/mass spectroscopy (GC/MS) tuning, instrument calibration, blank analysis, surrogate recovery, matrix spike/matrix spike duplicates, internal standards (IS) performance, Target Compound List (TCL) compound identification, compound quantitation and reported detection limits, tentatively identified compounds, system performance, and overall assessment of the data for usability.

The areas reviewed in the validation of inorganic data include the following: sample holding times, instrument calibration and initial calibration verification, continuing calibration verification, Contract Required Detection Limit (CRDL) standards for Atomic Absorption (AA) and Inductively Coupled Plasma (ICP) spectrometers, initial and continuing calibration blank analysis, ICP interference check sample analysis, spiked sample analysis, post digested spike sample recovery analysis, duplicate sample analysis, laboratory control sample analysis, ICP serial dilution analysis, graphite furnace AA QC analysis, quarterly verification of instrument parameter report, and sample result verification.

8.4 Identification and Treatment of Outliers

Any data point which deviates markedly from others in its set of measurements will be investigated; however, the suspected outlier will be recorded and retained in the data set. The following tests will be used to identify outliers.

Dixon's test for extreme observations is an easily computed procedure for determining whether a single very large or very small value is consistent with the remaining data. The one-tailed t-test for difference may also be used in this case. It should be noted that these tests are designed for testing a single value. If more than one outlier is suspected in the same data set, other statistical methods, such as analysis of variance, tolerance intervals, or control charts, will be considered and the most appropriate method will be used and documented.

Since an outlier may result from unique circumstances at the time of sample analysis or data collection, those persons involved in the analysis and data reduction will be consulted. This may provide information on an experimental reason for the outlier. Further statistical analysis will be performed with and without the outlier to determine its effect on the conclusions. In many cases, two data sets will be reported, one including and one excluding the outlier.

In summary, every effort will be made to include the outlying values in the reported data. If the value is rejected, it will be identified as an outlier, reported with its data set and its omission noted.

8.5 Analytical Deliverables

Analytical deliverables will meet the requirements of the USEPA CLP SOW for Organic Analysis; Multi-Media, Multi-Concentration, 3/90, revised July 1991, and the USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, 3/90, revised September 1991.

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1 Introduction

Quality control checks will be performed to ensure the collection of representative samples and the generation of valid analytical results on these samples. These checks will be performed by project participants through the program under the guidance of the TRC-EC QA Officer.

9.2 Data Collection and Sampling QC Procedures

The TRC-EC internal QC checks for the sampling aspects of this program will include, but not be limited to, the following:

- Use of field notebooks to ensure completeness, traceability, and comparability of the samples collected.
- Field checking of field notebooks and sample labels by a second person to ensure accuracy and completeness.
- Strict adherence to the sample chain-of-custody procedures outlined in Section 5 of this document.
- Collection and analysis of trip blanks, source blanks, field blanks, and field duplicates.
- Calibration of the field monitoring equipment (e.g., HNU, OVA), as described in Section 6 of this document.

9.3 Analytical QC Procedures

9.3.1 Trip Blank Analysis

Volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-faced silicone rubber septum of the sample vial. Therefore, trip blanks will be analyzed to monitor for possible sample contamination during shipment. Trip blanks will be prepared by filling two volatile vials with laboratory-supplied, organic-free water which then will be shipped with the field sampling kit. Trip blanks will be preserved by the laboratory with hydrochloric acid. Trip blanks accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples. Following the analyses, if the trip blanks indicate possible contamination of the samples, depending upon the nature and extent of the contamination, the sample results will be qualified with respect to the contamination detected in the trip blanks. Results of trip blank analyses will be maintained with the corresponding sample analyses data in the project file.

9.3.2 Reagent Blank Analysis

A reagent blank is a volume of deionized, distilled laboratory water carried through the entire analytical procedure. The volume of the blank must be approximately equal to the sample volume processed. A reagent blank should be performed with each group of samples. Analysis of the blank verifies that method interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware are known and minimized. Optimally, a reagent blank should meet CLP criteria. Results of reagent blank analyses will be maintained with the corresponding analytical data in the project file.

9.3.3 Duplicate Sample Analysis

Duplicate analyses are performed to evaluate the precision of an analysis. Results of the duplicate analyses are used to determine the relative percent differences between duplicate samples. Field (blind) duplicate samples will be collected for each media sampled at a frequency of one per ten samples collected. Duplicate analysis results will be reported together in the final RI report.

9.3.4 Verification/Reference Standard

On a quarterly basis, the laboratory Quality Control Coordinator introduces a group of prepared verification samples, or standard reference materials, into the analytical testing regime. The laboratory checks and approves the purity of standards and reagents prior to use. Results of the verification/reference standard data will be summarized, evaluated, and presented to laboratory management for review and corrective actions, if appropriate.

9.3.5 Other Laboratory Quality Control Checks

Quality control checks will be performed to ensure the collection of representative samples and the generation of valid analytical results on these samples. These checks are performed by project participants under the guidance of QC personnel.

The laboratory will make use of various types of QC samples to document the validity of the generated data. The following types of QC samples are routinely used:

> Calibration Check Samples--One of the working calibration standards which is periodically used to check that the original calibration is still valid.
>
> Spiked Samples--Replicate aliquots of project samples are spiked with components of interest and carried through the entire preparative and analytical scheme.
>
> Laboratory Control Samples (LCS)--These samples are prepared from EPA Environmental Monitoring Systems Laboratory (EMSL) concentrates or National Bureau of Standards (NBS) standard reference materials. The LCS are used to establish that an instrument or procedure is in control. An LCS is normally carried through the entire sample preparation and analysis procedure.
>
> Surrogate Spikes--Samples requiring analysis by GC/MS are routinely surrogate-spiked with a series of deuterated analogues of the components of interest. It is anticipated that these compounds would assess the behavior of actual components in individual program samples during the entire preparation and analysis scheme.
>
> Matrix Spikes/Matrix Spike Duplicates (MS/MSD)--One MS/MSD pair will be run per 20 samples for each different matrix analyzed. These pairs will be spiked with the target compounds of concern for that matrix.

All values which fall outside the QC limits described in the analytical method will be noted. The following analytical guidelines will be used to check recovery values which fall outside the QC limits:

1. All recovery data are evaluated to determine if the QC limits are appropriate and if a problem may exist even though the limits are being achieved (e.g., one compound that is consistently barely within the lower limit).

2. All recovery data which are outside the established limits are evaluated. This evaluation includes an independent check of the calculation.

3. Corrective action is performed if any of the following are observed:

- All recovery values in any one analysis are outside the established limits.
- Over 50 percent of the values for a given sample set are outside limits.
- One compound is outside the limits in over 50 percent of the samples.

Reagents used in the laboratory are normally of analytical reagent grade or higher purity. Each lot of acid or solvent used is checked for acceptability prior to laboratory use. All reagents are labeled with the date received and date opened. All glassware is precleaned according to specifications contained in the analytical method. Standard laboratory practices for laboratory cleanliness, personnel training, and other general procedures are used. A summary of all laboratory quality control analyses and the corresponding control determination is presented in Table 11.

9.3.6 Laboratory Control Charts

The control chart displays data in a format which graphically compares the variability of all test results with the average or expected variability of small groups of data. The variability may be due to random (indeterminate) or assignable (determinate) causes. The control chart distinguishes indeterminate from determinate variation in a process or method by its control limits. If a value falls outside the control limits, it is considered out-of-control, almost certainly due to a determinate cause which has been added to the indeterminate variations. The control chart signals the need to investigate, find the determinate cause, and correct it. Construction of a control chart requires a minimum of 14 to 20 duplicate sets of data points (which limits its use).

QC samples and instrument calibrations lend themselves most readily to the gathering of the data. Calculation of control limits and the values are usually plotted chronologically so that trends or cycles can be readily detected. If QC sample measurements show an out-of-control condition, it can be expected that subsequent sample analyses might yield invalid data. The control chart is an effective indicator of the need for corrective action.

For volatile and semi-volatile organics and pesticide analyses performed by GC/MS, surrogate recoveries from the method blank are the control sample. For other organics (e.g., PCBs, dioxins/furans), an LCS (spiked blank) is used to plot the control charts. An LCS is also used as the control point for inorganic analyses.

10.0 PREVENTIVE MAINTENANCE

10.1 Preventive Maintenance Procedures

Field equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

The laboratory will follow an orderly program of positive actions to prevent the failure of laboratory equipment or instruments during use. This preventive maintenance and careful calibration helps to assure accurate measurements from instrumentation. Routine maintenance procedures are followed for all instruments, glassware, reagents, analytical balances, and equipment used to produce deionized water. Specific procedures will be outlined in the laboratory Standard Operating Procedures (SOPs).

10.2 Schedules

Manufacturer's procedures identify the schedule for servicing critical items in order to minimize the downtime of the measurement system. It will be the responsibility of the operator to adhere to this maintenance schedule and to arrange any necessary and prompt service as required. Service to the equipment, instruments, tools, gauges, etc., shall be performed by qualified personnel.

In the absence of any manufacturer's recommended maintenance criteria, a maintenance procedure will be developed by the operator based upon experience and previous use of the equipment.

10.3 Records

Logs are maintained to record maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories and by the data and sample control personnel when and if equipment, instruments, tools and gauges are used at the site. The project QA officer may audit these records to verify complete adherence to these procedures.

10.4 Spare Parts

Critical spare parts are maintained by TRC-EC and the laboratory for field and analytical equipment, respectively. These spare parts will be stored for availability and used in order to reduce equipment downtime.

11.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

11.1 Introduction

Procedures used to assess data precision and accuracy will be in accordance with 44 FR 69533 "Guidelines Establishing Test Procedures for the Analyses of Pollutants", Appendix III Example Quality Assurance and Quality Control Procedures for Organic Priority Pollutants", December 3, 1979. Completeness is recorded by comparing the number of parameters initially analyzed with the number of parameters successfully completed and validated. For this project, a target control limit of greater than 90 percent will be used.

11.2 Accuracy

The percent recovery is calculated as:

$$\% = \frac{S_o - S_s}{S} \times 100$$

where: So = The background value, i.e., the value obtained by analyzing the sample.

S = Concentration of the spike added to the sample.

Ss = Value obtained by analyzing the sample with the spike added.

% = Percent recovery.

11.3 Precision

The relative percent difference is calculated as:

$$1/2 \times \frac{(V_1 - V_2)}{(V_1 + V_2)} \times 100 = \%\ \text{difference}$$

where: V1,V2 = The two values obtained by analyzing the duplicate samples.

11.4 Completeness

Completeness will be reported as the percentage of all measurements made whose results are judged to be valid. The procedures to be used for validating data and determination of outliers are contained in Section 8.0 of this QAPP. The following formula will be used to estimate completeness:

$$C = 100 \times \frac{V}{T}$$

where: C = Percent completeness.

V = Number of measurements judged valid.

T = Total number of measurements.

12.0 CORRECTIVE ACTION

12.1 Introduction

The acceptance limits for the sampling and analyses under this program will be those stated in the method or defined by other means in the QAPP. Corrective actions are often immediate in nature, implemented by the analyst or Project Manager. The corrective action usually involves recalculation, reanalysis, or repeating sample collection.

12.2 Immediate Corrective Action

If an immediate corrective action can be taken as part of normal operating procedures, the collection of poor quality data can be avoided. Instrument and equipment malfunctions are amenable to this type of action. QC procedures include troubleshooting guides and corrective action suggestions. The actions taken will be noted in field or laboratory notebooks, but no other formal documentation is required, unless further corrective action is necessary. These on-the-spot corrective actions are an everyday part of the QA/QC system.

Corrective action during the field sampling portion of a program is most often a result of equipment failure or an operator oversight and may require repeating a sampling run. Operator oversight is best avoided by having field crew members audit each others' work before and after a test. Every effort will be made by the field team leader to ensure that all QC procedures are followed. If potential problems are not solved as an immediate corrective action, TRC-EC will apply formalized long-term corrective action, if necessary.

Corrective action for analytical work will include recalibration of instruments, reanalysis of known QC samples and, if necessary, reanalysis of actual field samples. Specific QC procedures and checklists are used by the laboratory to help analysts detect the need for corrective action. Often the person's experience will be valuable in alerting the operator to suspicious data or malfunctioning equipment.

12.3 Long-Term Corrective Action

The need for long-term corrective action may be identified by standard QC procedures, control charts, performance or system audits. Any quality problem which cannot be solved by immediate corrective action falls into the long-term category. The TRC-EC QA system ensures that the quality problem is reported to a person responsible for correcting it, and who is part of a closed-loop action and follow-up plan.

The essential steps in the closed-loop corrective action system are listed below:

- Identify and define the problem;
- Assign responsibility for investigating the problem;
- Investigate and determine the cause of the problem;
- Determine a corrective action to eliminate the problem;
- Assign and accept responsibility for implementing the corrective action;
- Establish effectiveness of the corrective action and implement it; and
- Verify that the corrective action has eliminated the problem.

Documentation of the problem is important to the system. A Corrective Action Request Form (Figure 3) is filled out by the person finding the quality problem. This form identifies the problem, possible causes, and the person responsible for action on the problem. The responsible person may be an analyst, field team leader, QC coordinator, or the QA Officer. If no person is identified as responsible for action, the QA Officer investigates the situation and determines who is responsible in each case.

The Corrective Action Request Form includes a description of the corrective action planned and the date it was taken, and space for follow-up. The QA Officer checks to be sure that initial action has been taken and appears effective and, at an appropriate later date, checks again to see if the problem has been fully solved. The QA Officer receives a copy of all Corrective Action Forms and enters them in the Corrective Action Log. This permanent record aids the QA Officer in follow-up and makes any quality problems visible to management. The log may also prove valuable in listing a similar problem and its solution.

12.4 Out-of-Control Events and Corrective Action

Procedures are outlined as to what corrective action is taken if an out-of-control event occurs, and how it is documented and used to improve laboratory performance. Procedures for assuring that results for samples processed during out-of-control conditions are not reported are also outlined, as well as the conditions necessary to reestablish control and criteria for assuring the system is operating properly. The documentation is easily used by all personnel and is part of routine laboratory procedure.

It is recognized that several levels of out-of-control events may occur. Three examples are given below with corrective actions to be taken:

1. Observations Corrected by Analyst at the Bench--The calibration of an instrument is not linear. The analyst finds this and corrects it prior to continuing to analyze samples. The laboratory documents this event and notes that the corrective action was to recalibrate, and that no samples were affected as none were analyzed prior to calibration.

2. Corrective Actions Taken by Supervisor--A matrix spike recovery is out-of-control and the laboratory supervisor finds this after the samples for the day have been analyzed. The supervisor documents that the laboratory blank spiked with surrogates or standards was in control and that other sample spikes were in control, therefore, no re-analysis of the sample is required.

3. Corrective Actions at the Receiving Level--The sample container is broken. The analyst notes this and documents whether or not more sample is available. If no more sample is available, TRC-EC is notified and the decision documented.

13.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

13.1 Internal TRC-EC Reports

The Project QC Coordinator will provide monthly reports of QC activities for the TRC-EC QA Officer and QA/QC Manager. These reports detail the results of quality control analysis, problems encountered, and any corrective action required.

All Corrective Action Forms will be submitted to the TRC-EC QA Officer for initial approval of the corrective action planned. A copy will be provided to the appropriate technical division manager. All system audit reports will be provided to the Program Manager and Project Manager.

13.2 Laboratory Reports

The laboratory QC Coordinator prepares written quarterly reports on QC activities for the laboratory Technical Director and QA Manager. These reports detail the results of QA procedures, problems encountered, and any corrective action which may have been required. All Corrective Action forms are submitted to the QA Manager for initial approval of the planned corrective action, and a copy is provided to the Technical Director. All system audit reports are provided to the Technical Director.

Each data transmittal contains a summary of QA/QC activities; this summary will include:

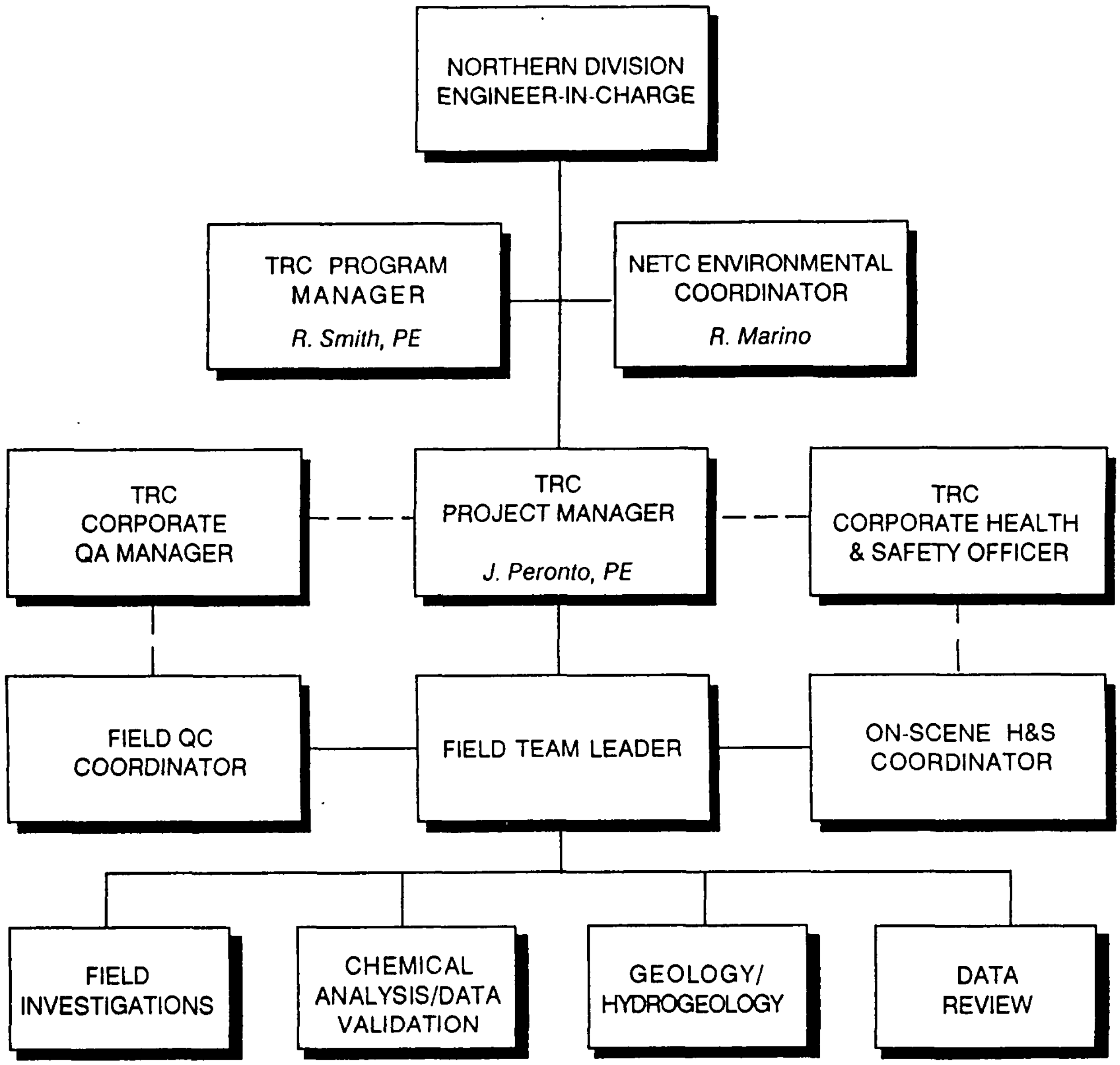
- Estimates of precision, accuracy and completeness of data;
- Reports of performance and system audits;
- Quality problems found; and
- Corrective actions taken.

The final data report submitted to TRC-EC by the laboratory will include a summary of QA/QC activities during the project. The QC Coordinator and QA Manager will participate in preparing this report. The summary of QA/QC results for the analytical work conducted for the NETC-Newport project will be included in the final RI Report.

13.3 Reports to the U.S. Navy Northern Division

The status of on-going laboratory QA/QC activity will be presented in the project progress reports. Monthly progress reports will be sent from the laboratory to the Navy's Engineer-In-Charge and NEESA QA/QC contract representative, as required. The final RI report for the project will include a section summarizing the significant findings of all QA/QC laboratory activity.

FIGURES



TRC
TRC Environmental Corporation

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NAVAL EDUCATION AND TRAINING CENTER — *NEWPORT RHODE ISLAND*

FIGURE 1.

PROJECT ORGANIZATION

Date 9/92 | Drawing No 6760-N81

TRC
TRC Environmental Corporation

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME					NO. OF CONTAINERS	PARAMETERS								№ 2043
SAMPLERS: *(Signature)*					(Printed)										REMARKS
FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION										

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
(Printed)		(Printed)	(Printed)		(Printed)
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow), Copy to Coordinator Field Files (pink)

FIGURE 2. CHAIN OF CUSTODY RECORD

FIGURE 3
CORRECTIVE ACTION REQUEST FORM

CORRECTIVE ACTION REQUEST FOR NO. ________

Originator ______________________ Date ______________________

Person Responsible
for Replying ______________________ Contract
Involved ______________________

Description of problem and when identified: ______________________

____

____

____

State cause of problem, if known or suspected: ______________________

____

____

Sequence of Corrective Action: (If no responsible person is identified, notify QA Officer immediately. Submit all CA forms to QA Officer for initial approval of CA.)

State Date, Person, and Action Planned: ______________________

____

____

____

____

____

____

____

____

____

____

CA Initially Approved by: ______________________ Date: ____________

Follow-up Dates: ______________________

Final CA Approval by: ______________________ Date: ____________

Information copies to:

RESPONSIBLE PERSON/QC COORDINATOR: ______________________

QA OFFICER: ______________________

PROJECT MANAGER: ______________________

TABLES

TABLE 1

CONTAINERS AND PRESERVATION METHODS
FOR SOIL AND WASTE SAMPLES

Number Containers per Sample	Sample Container	Preservation Methods[a]	Analytical Method	Compounds (2)
Organics				
2	125 ml, wide-mouth glass, Teflon -lined cap	Cool, 4°C	CLP SOW	TCL VOA
1	1-250 ml, wide-mouth amber glass, Teflon -lined cap	Cool, 4°C	CLP SOW	TCL-BNA, P/P
				Hydrocarbons
Inorganics				
1	250-ml, wide-mouth glass, Teflon -lined cap	Cool, 4°C	CLP SOW[b]	Metals and Cyanide

VOA = Volatile Organic Analyses.
TCL = Target Compound List.
BNA = Base Neutral and Acid Extractable Analyses.
P/P = Pesticide/PCB Analyses.
CLP SOW = Contract Laboratory Program - Statement of Work.
Organics - SOW 3/90, revised July 1991.
Inorganics - SOW 3/90, revised September 1991.

[a] All samples will be stored in a refrigerated, dark area.

[b] Metals analyses, except mercury, will be performed by the furnace atomic absorption (As, Pb, Se, Tl) and inductively coupled plasma (ICP) atomic emission spectrometric methods. Mercury will be analyzed by the manual cold vapor atomic absorption method. Total cyanide will be analyzed by the manual spectrophotometric method.

TABLE 2

CONTAINERS AND PRESERVATION METHODS FOR AQUEOUS SAMPLES

Number Containers per Sample[a]	Sample Container	Preservation Methods[b]	Analytical Method	Compound(s)
<u>Organics</u>				
2	40 ml, glass, Teflon -lined cap	Cool, 4°C HCl to pH < 2	CLP SOW	TCL-VOA
1	1-gal, narrow-mouth amber glass, Teflon -lined cap	Cool, 4°C	CLP SOW	TCL-BNA, P/P
<u>Inorganics</u>				
1	500 ml, polyethylene	Cool, 4°C HNO_3 to pH <2	CLP SOW[c]	Metals
1	1 L, polyethylene	Cool, 4°C NaOH to pH >12[d]	CLP SOW[c]	Cyanide

TCL = Target Compound List.
VOA = Volatile Organic Analyses.
BNA = Base Neutral and Acid Extractable Compounds.
P/P = Pesticides/PCB Analyses.
CLP SOW = Contract Laboratory Program - Statement of Work.
Organics - SOW 3/90, revised August 1991.
Inorganics - SOW 3/90, March 1990.

(a) One in 20 organic aqueous samples will be collected in triplicate for matrix spike and matrix spike duplicate analyses in accordance with CLP protocols; one in 20 inorganic aqueous samples will be collected in duplicate for matrix spike analyses.

(b) All samples will be stored in a refrigerated, dark area.

(c) Metals analyses, except mercury, will be performed by the furnace atomic absorption (As, Pb, Se, Tl) and inductively coupled plasma (ICP) atomic emission spectrometric methods. Mercury will be analyzed by the manual cold vapor atomic absorption method. Total cyanide will be analyzed by the manual spectrophotometric method.

(d) Water samples to be analyzed for cyanide will be checked in the field for the presence of chlorine using potassium iodide (KI) starch paper. If chlorine is present, 0.6 g ascorbic acid will be added.

TABLE 3

HOLDINGS TIMES FOR SOIL, AQUEOUS
AND/OR WASTE SAMPLES

Parameter	CLP Holding Time for Samples	
	Aqueous	Soil/Sediment/Waste
TCL Volatile Organic Compounds	10 days from VTSR	10 days from VTSR
TCL Base Neutral/Acid and Extractable Compounds	5 days to extraction from VTSR; 40 days from extraction	7 days[1] extraction from VTSR; 40 days from extraction
TCL Pesticide/PCB Compounds	5 days to extraction; 40 days from extraction	7 days[1] to extraction; 40 days from extraction
Petroleum Hydrocarbons	NA	NA
TAL Metals and Cyanide	6 months; except Hg - 26 days and Cn-12 days	6 months; except Hg - 26 days and Cn-12 days
Dioxins/Furans	NA	NA

NA = Not applicable; no holding times established according to the CLP SOW.

VTSR = Verified Time of Sample Receipt.

[1] = U.S. EPA Region I requirement.

TABLE 4

FIELD QC SAMPLES PER SAMPLING EVENT
(NEESA GUIDANCE FOR LEVEL D)

Type of Sample	Level C	
	Metals	Organics
Trip blank (for volatiles only)	NA[a]	1/cooler
Field blank	1/20 samples per matrix or 1/day/matrix for all analytes, whichever is greater	
Source water blank	1/each source of water	
Field duplicates[c]	10%	10%
Regulatory splits	AN[b]	AN[b]

a NA - Not applicable.

b AN - As needed.

c All field duplicates will be submitted as "blind" duplicates for quality control determinations.

TABLE 5

TARGET COMPOUND LIST (TCL) VOLATILE COMPOUNDS AND DETECTION LIMITS

Volatiles	CAS Number	Detection Limits[a] Water (ug/l)	Low Soil/Sediment[b] (ug/kg)
Chloromethane	74-87-3	10	10
Bromomethane	74-83-9	10	10
Vinyl chloride	75-01-4	10	10
Chloroethane	75-00-3	10	10
Methylene chloride	75-09-2	10	10
Acetone	67-64-1	10	10
Carbon disulfide	75-15-0	10	10
1,1-Dichloroethene	75-35-4	10	10
1,1-Dichloroethane	75-35-3	10	10
1,2-Dichloroethene (total)	156-60-5	10	10
Chloroform	67-66-3	10	10
1,2-Dichloroethane	107-06-2	10	10
2-Butanone	78-93-3	10	10
1,1,1-Trichloroethane	71-55-6	10	10
Carbon tetrachloride	56-23-5	10	10
Bromodichloromethane	75-27-4	10	10
1,2-Dichloropropane	78-87-5	10	10
cis-1,3-Dichloropropene	10061-01-5	10	10
Trichloroethene	79-01-6	10	10
Dibromochloromethane	124-48-1	10	10
1,1,2-Trichloroethane	79-00-5	10	10
Benzene	71-43-2	10	10
trans-1,3-Dichloropropene	10061-02-6	10	10
Bromoform	75-25-2	10	10
4-Methyl-2-pentanone	108-10-1	10	10

TABLE 5

(Continued)

TARGET COMPOUND LIST (TCL) VOLATILE
COMPOUNDS AND DETECTION LIMITS

Volatiles	CAS Number	Detection Limits[a] Water (ug/l)	Detection Limits[a] Low Soil/Sediment[b] (ug/kg)
2-Hexanone	591-78-6	10	10
Tetrachloroethene	127-18-4	10	10
Toluene	108-88-3	10	10
1,1,2,2-Tetrachloroethane	79-34-5	10	10
Chlorobenzene	108-90-7	10	10
Ethyl benzene	100-41-4	10	10
Styrene	100-42-5	10	10
Total xylenes	1330-20-7	10	10

(a) Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated for soil/sediment calculated on dry weight basis will be higher.

(b) Medium soil/sediment detection limits for volatile TCL compounds are 120 times the individual low soil/sediment detection limits.

Note: Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

TABLE 6

TARGET COMPOUND LIST (TCL) SEMIVOLATILE COMPOUNDS AND DETECTION LIMITS

Semivolatiles	CAS Number	Detection Limits[a] Water (ug/l)	Low Soil/Sediment[b] (ug/kg)
Phenol	108-95-2	10	330
Bis(2-chloroethyl)ether	111-44-4	10	330
2-Chlorophenol	95-57-8	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
1,2-Dichlorobenzene	95-50-1	10	330
2-Methylphenol	95-48-7	10	330
2,2'-oxybis(1-Chloropropane)[c]	108-60-1	10	330
4-Methylphenol	106-44-5	10	330
N-Nitroso-di-n-propylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-Nitrophenol	88-75-5	10	330
2,4-Dimethylphenol	105-67-9	10	330
Bis(2-chloroethoxy)methane	111-91-1	10	330
2,4-Dichlorophenol	120-83-2	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-Chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	330
4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
2-Methylnaphthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
2,4,6-Trichlorophenol	88-06-2	10	330
2,4,5-Trichlorophenol	95-95-4	25	800
2-Chloronaphthalene	91-58-7	10	330
2-Nitroaniline	88-74-4	25	800

TABLE 6

(Continued)

TARGET COMPOUND LIST (TCL) SEMIVOLATILE COMPOUNDS AND DETECTION LIMITS

Semivolatiles	CAS Number	Detection Limits[a] Water (ug/l)	Low Soil/Sediment[b] (ug/kg)
Dimethylphthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
2,6-Dinitrotoluene	606-20-2	10	330
3-Nitroaniline	99-09-2	25	800
Acenaphthene	83-32-9	10	330
2,4-Dinitrophenol	51-28-5	25	800
4-Nitrophenol	100-02-7	25	800
Dibenzofuran	132-64-9	10	330
2,4-Dinitrotoluene	121-14-2	10	330
Diethylphthalate	84-66-2	10	330
4-Chlorophenyl-phenylether	7005-72-3	10	330
Fluorene	86-73-7	10	330
4-Nitroaniline	100-01-6	25	800
4,6-Dinitro-2-methylphenol	534-52-1	25	800
N-nitrosodiphenylamine	86-30-6	10	330
4-Bromophenyl-phenylether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	25	800
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Carbazole	86-74-8	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butylbenzylphthalate	85-68-7	10	330
3,3'-Dichlorobenzidine	91-94-1	10	330

TABLE 6

(Continued)

TARGET COMPOUND LIST (TCL) SEMIVOLATILE COMPOUNDS AND DETECTION LIMITS

Semivolatiles	CAS Number	Detection Limits[a] Water (ug/l)	Detection Limits[a] Low Soil/Sediment[b] (ug/kg)
Benzo(a)anthracene	56-55-3	10	330
Chrysene	218-01-9	10	330
Bis(2-ethylhexyl)phthalate	117-81-7	10	330
Di-n-octylphthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(a)pyrene	50-32-8	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenzo(a,h)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330

(a) Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated for soil/sediment calculated on dry weight basis will be higher.

(b) Medium soil/sediment detection limits for semivolatile TCL compounds with a low detection limit of 330 ug/kg are 10,000 ug/kg; for semivolatiles with a low detection limit of 800 ug/kg, they are 25,000 ug/kg.

(c) Previously known by the name bis(2-chloroisopropyl)ether.

Note: Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

TABLE 7

TARGET COMPOUND LIST (TCL) PESTICIDES, PCBs, AND DETECTION LIMITS

Pesticides/PCBs	CAS Number	Detection Limits[a] Water (ug/l)	Soil/Sediment[b] (ug/kg)
alpha-BHC	319-84-6	0.05	1.7
beta-BHC	319-85-7	0.05	1.7
delta-BHC	319-86-8	0.05	1.7
gamma-BHC (Lindane)	58-89-9	0.05	1.7
Heptachlor	76-44-8	0.05	1.7
Aldrin	309-00-2	0.05	1.7
Heptachlor epoxide	1024-57-3	0.05	1.7
Endosulfan I	959-98-8	0.05	1.7
Dieldrin	60-57-1	0.10	3.3
4,4'-DDE	72-55-9	0.10	3.3
Endrin	72-20-8	0.10	3.3
Endosulfan II	33213-65-9	0.10	3.3
4,4'-DDD	72-54-8	0.10	3.3
Endosulfan sulfate	1031-07-8	0.10	3.3
4,4'-DDT	50-29-3	0.10	3.3
Methoxychlor	72-43-5	0.50	17.0
Endrin ketone	53494-70-5	0.10	3.3
Endrin aldehyde	7421-93-4	0.10	3.3
alpha-Chlordane	5103-71-9	0.05	1.7
gamma-Chlordane	5103-74-2	0.05	1.7
Toxaphene	8001-35-2	5.0	170.0
AROCLOR-1016	12674-11-2	1.0	33.0
AROCLOR-1221	11104-28-2	2.0	67.0
AROCLOR-1232	11141-16-5	1.0	33.0
AROCLOR-1242	53469-21-9	1.0	33.0
AROCLOR-1248	12672-29-6	1.0	33.0
AROCLOR-1254	11097-69-1	1.0	33.0
AROCLOR-1260	11096-82-5	1.0	33.0

(a) Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated for soil/sediment calculated on dry weight basis will be higher.

(b) There is no differentiation between the preparation of low and medium soil samples in this method for the ?analysis of pesticides/aroclors.

Note: Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

TABLE 8

SURROGATE SPIKE RECOVERY RANGE

Fraction	Surrogate Compounds	Water % Recovery	Soil/Sediment % Recovery
Volatiles	Toluene-d_8	88-110	84-138
	Bromofluorobenzene	86-115	59-113
	1,2-Dichloroethane-d_4	76-114	70-121
Semi-Volatiles	Nitrobenzene-d_5	35-114	23-120
	2-Fluorobiphenyl	43-116	30-115
	Terphenyl-d_{14}	33-141	18-137
	Phenol-d_5	10-110	24-113
	2-Fluorophenol	21-110	25-121
	2,4,6-Tribromophenol	10-123	19-122
	2-Chlorophenol-d_4	33-110	(20-130)[a]
	1,2-Dichlorobenzene-d_4	16-110	(20-130)[a]
Pesticides	Tetrachloro-m-xylene	(60-150)[a]	(60-150)[a]
	Decachlorobiphenyl	(60-150)[a]	(60-150)[a]

[a] Advisory limits only

TABLE 9

MATRIX SPIKE RECOVERY LIMITS

Fraction	Matrix Spike Compound	Water[a]	Soil/Sediment[a]
VOA	1,1-Dichloroethene	61-145	59-172
VOA	Trichloroethene	71-120	62-137
VOA	Chlorobenzene	75-130	60-133
VOA	Toluene	76-125	59-139
VOA	Benzene	76-127	66-142
BN	1,2,4-Trichlorobenzene	39-98	38-107
BN	Acenaphthene	46-118	31-137
BN	2,4-Dinitrotoluene	24-96	28-89
BN	Pyrene	26-127	35-142
BN	N-Nitroso-di-n-propylamine	41-116	41-126
BN	1,4-Dichlorobenzene	36-97	28-104
Acid	Pentachlorophenol	9-103	17-109
Acid	Phenol	12-110	26-90
Acid	2-Chlorophenol	27-123	25-102
Acid	4-Chloro-3-methylphenol	23-97	26-103
Acid	4-Nitrophenol	10-80	11-114
Pesticide	gamma-BHC (Lindane)	56-123	46-127
Pesticide	Heptachlor	40-131	35-130
Pesticide	Aldrin	40-120	34-132
Pesticide	Dieldrin	52-126	31-134
Pesticide	Endrin	56-121	42-139
Pesticide	4,4'-DDT	38-127	23-134

[a] These limits are for advisory purposes only. They are not to be used to determine if a sample should be reanalyzed. When sufficient multi-laboratory data are available, standard limits will be calculated.

TABLE 10

TARGET ANALYTE LIST (TAL) INORGANICS AND CONTRACT REQUIRED DETECTION LIMITS (CRDL)[a]

Element	Detection Limit Water (ug/l)	Detection Limit Low Soil/Sediment (ug/g)
Aluminum	200	40
Antimony	60	12
Arsenic	10	2
Barium	200	40
Beryllium	5	1
Cadmium	1.5[c]	1
Calcium	5,000	1,000
Chromium	10	2
Cobalt	50	10
Copper	12[d]	5
Iron	100	20
Lead	3	1
Magnesium	5,000	1,000
Manganese	15	3
Mercury	0.05[e]	0.1[b]
Nickel	40	8
Potassium	5,000	1,000
Selenium	5	1
Silver	1[c]	2
Sodium	5,000	1,000
Thallium	10	2
Vanadium	50	10
Zinc	20	4
Cyanide	10	1

(a) Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable. Soil/sediment CRDLs are based on sample wet weights. Dry weight CRDLs will depend on the moisture content of the individual samples.

b Different aliquot.

c Obtain CRDL by using Graphite Furnace Atomic Absorption (AA).

d Obtain CRDL by using Inductively Coupled Plasma (ICP).

e Obtain CRDL by using Cold Vapor Atomic Absorption (AA).

TABLE 11

LABORATORY QUALITY CONTROL ANALYSES

Analysis type	Frequency[a]	Control
Organic analyses		
Blank	1	Surrogate compounds
LCS and/or spiked blank	1	% recovery, analytes of interest
Duplicate	2	RPD
Matrix spike	1	% recovery of target analyte(s)
Matrix spike duplicate	1	RPD and % recovery
Inorganic Analyses		
Blank	1	No contamination
LCS and/or spiked blank	1	% recovery, analytes of interest
Duplicate	1	RPD
Matrix spike	1	% recovery of target analyte(s)

[a] Frequency is based on a batch of 20 samples or less of a similar matrix or whenever samples are extracted, whichever is more frequent.

LCS = Laboratory Control Sample

RPD = Relative Percent Difference

TABLE 12

SITE 02 – MELVILLE NORTH LANDFILL
SUMMARY OF PHASE II RI/FS ANALYSES

ACTIVITY / SAMPLE MATRIX	SCOPE OF WORK	NUMBER OF SAMPLES	SAMPLE ANALYSIS
<u>GEOPHYSICS</u> Seismic Refraction	Multiple traverses	NA	NA
SOIL GAS	2 areas	30 Points	NA
SURFACE SOIL	10 Locations	10	TCL/TAL
TEST BORINGS	12 Locations	24 – 36	TCL/TAL
WELL BORINGS	9 Borings	18 – 27	TCL/TAL
GROUND WATER	12 wells at 9 new locations: 6 shallow wells, 3 shallow/bedrock wells, & 1 bedrock well	17 (1 per Phase II well + 5 existing wells)	17 TCL /22 TAL

Note: "NA" indicates that activity is not applicable.
TCL indicates sample will be analyzed for Target Compound List.
TAL indicates sample will be analyzed for Target Analyte List.
In addition to dissolved (filtered metals), five ground water samples will also be analyzed for BOD, COD, and TSS for treatability information.

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

APPENDIX E
INVESTIGATION DERIVED WASTE PLAN

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

-Draft-
September, 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

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INVESTIGATION DERIVED WASTE PLAN

1.0 INTRODUCTION

This plan presents a discussion of the planned management procedures for all field generated or investigation derived waste materials. Investigation derived waste (IDW) materials typically include soil boring drill cuttings, monitoring well development water and purge water, sampling equipment decontamination solutions, and expendable personnel protective equipment. During the field investigation activities, care will be taken to minimize the amount of IDW material which is generated and handled. The following sections provide the planned management and handling procedures for IDW materials during the field investigation activities.

1.1 WASTE MANAGEMENT

Generally, IDW materials will be placed in DOT-approved 55-gallon drums. Drums will be filled to no more than 90 percent of capacity to allow for the potential expansion of the drum contents. Drums will be marked with sticker labels and indelible liquid chalk pens by field investigation personnel. Drum labels will be of a contrasting color (e.g., yellow) relative to the drums (e.g., black). Information recorded on the drums and labels will include:

generator (US Navy, Naval Education Training Center, Newport, Rhode Island, 02841)

generator EPA identification number,

source (e.g., site number and name, well or boring number),

date(s) of generation,

matrix (e.g., soil, water, etc.), and

notes/observations (e.g., odors, non-aqueous phase liquids, etc.)

The handling and disposal of all IDW materials will be the responsibility of the US Navy with assistance provided by TRC-ECI. The RIDEM and EPA - Region I will be consulted regarding the final disposition of all IDW material.

1.2 WASTE HANDLING & DISPOSAL

1.2.1 Soils

Solid material derived from the subsurface exploration program (e.g., auger spoils, split spoon samples, etc.) will be continuously observed for evidence of potential contamination (e.g., discoloration, odors, etc.) and monitored for the presence of VOCs using a photo and/or flame ionization detector (PID or FID).

Drill cuttings produced from test borings will be backfilled into their respective borings and a cement-bentonite grout will be placed in the top one foot of the borehole as described in the Field Sampling Methodology Plan provided as Appendix B. Drill cuttings produced from monitoring well borings will be containerized in 55-gallon drums.

Drummed well boring cuttings will be segregated on pallets and staged on-site at the completion of the drilling activities. The Navy will be responsible for staging all drums. The designated on-site drum staging areas will be established during the field mobilization activities. Analytical results of soil samples collected from well borings will be used to aid in characterizing the associated drummed cuttings.

If full scan (i.e., TCL organics and TAL inorganics) analytical results of soil samples from the test boring and field observations (odors, discoloration, elevated PID or FID readings, etc.) indicate the absence of contamination, the associated drummed soil will be returned to the ground surface near their respective source well location. So as not to interfere with future well sampling events, IDW material will not be placed closer than ten feet, nor further than twenty feet from its source location. The location(s) where any drill cuttings are placed will be recorded in a field notebook.

If field observations (e.g. stains, odors, or elevated PID or FID readings) or the analytical results of soil samples from the boring indicate that the associated drill cuttings are potentially contaminated, the drum contents will be sampled and appropriately characterized. The waste characterization testing will include that required under the state and federal regulations and by the planned disposal facility.

If characterization of the drums contents indicates the drill cuttings are hazardous, the drummed IDW materials will be transported by a licensed waste hauler for treatment or disposal in accordance with applicable state and federal regulations established under the Resource Conservation and Recovery Act (RCRA). Drill cuttings that do not exhibit any hazardous characteristics but appear contaminated based upon associated TCL/TAL results will be handled on a case-by-case basis. The EPA Region I and RIDEM will be consulted prior to redepositing any IDW materials on the sites.

1.2.2 Well Water

All well water (e.g., purge and development water) produced from site monitoring wells will be containerized in 55-gallon drums. The presence/absence of a non-aqueous phase liquid will be assessed in each well during well development, purging, and sampling. Any nonaqueous phase liquids or evidence of possible petroleum contamination (i.e., sheen, odor, elevated OVA response) which are detected or observed in the well will be recorded in a field notebook.

Analytical results of the ground water samples collected from the well will be used to aid in characterizing the drum contents. If associated ground water sample TCL/TAL analytical results and field observations (e.g., odors, sheen, elevated OVA response) indicate the absence of contamination, the associated drummed well water will be discharged onto the ground in the vicinity of the respective source well. The well water will not be discharged closer than ten feet, nor further than twenty feet from its source well. The location(s) of the discharged well water will be recorded in a field notebook. The EPA Region I and RIDEM will be consulted prior to discharging any IDW material on the sites.

If field observations and/or associated sample data indicate that the well water is contaminated, the drummed material will be transported for treatment by a licensed hauler in accordance with local, state, and federal regulations. The treatment of wastewaters at a local publically-owned treatment works will be considered, if appropriate.

1.2.3 Decontamination Solutions

Downhole drilling equipment (e.g., augers, rods, cutting heads) will be steam cleaned prior to each use. Steam cleaning will be conducted in a designated heavy equipment decontamination area. Rinse waters from steam cleaning will be recovered and contained in a tank truck located at the heavy equipment decontamination area for characterization and appropriate off-site treatment.

Sediment/soil generated from steam cleaning operations will be drummed separately at the decontamination area for appropriate characterization and proper disposal.

Chemicals (e.g., hexane, methanol, nitric acid) and water (distilled and tap) used for decontamination of sampling equipment (e.g., split spoons) will be separately collected, containerized, and labelled for proper treatment or disposal. In general, much of the sampling equipment (e.g., stainless steel spoon, bailers) will be laboratory decontaminated, thus reducing the generation of chemical decontamination solutions in the field.

1.2.4 Expendable Equipment

Expendable equipment (e.g., tyvek coveralls, gloves, boot covers, etc.) will be placed into trash bags and disposed of in Newport Naval Base outdoor refuse containers. Refuse containers to be used for such disposal will be designated by the NETC Public Works Department. Expendable equipment which is known or believed to be contaminated (e.g., oily gloves) will not be disposed of in refuse containers. Such equipment will be drummed, labelled, and segregated for disposal.

U.S. DEPARTMENT OF NAVY
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VOLUME IV
DATA EVALUATION AND ASSESSMENT PLAN

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared For:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

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1.0 INTRODUCTION

Data evaluation and assessment describes the process of characterizing the site on the basis of background investigations, site observations, and field investigations. The objective of this task is to define the nature and extent of contamination, identify and evaluate potential chemical transport mechanisms and the environmental fate of identified contaminants, and thereby provide the basis for human health risk assessments. Data management and reporting activities are key to conducting the site characterization activities.

2.0 DATA MANAGEMENT PLAN

Data management activities include field sampling documentation, sample management and tracking, analytical reporting, and document control.

2.1 Field Data Collection and Recording

During field sampling, consistent documentation and accurate recordkeeping procedures are critical. Data management procedures for field sampling at NETC-Newport during Phase II investigations will include the following:

> Quality Assurance Project Plan (QAPP)-- Provides procedures and protocols for records responsibility; nonconformity events; corrective measures; and data deficiencies. The QAPP for NETC-Newport appears in Appendix D of Volume III of this Work Plan.
>
> Data Security System and Chain-of-Custody--The QAPP describes strict chain-of-custody procedures which will be followed in the field and through sample analysis at the laboratory. Chain-of-custody records and shipping air bills will be maintained in a locked file cabinet at the TRC-EC field office at NETC-Newport. At the completion of field work, chain-of-custody records will be transferred to the central project file at the TRC-EC Windsor, Connecticut office.
>
> Field Notebooks--Field notebooks maintained by field personnel will be the primary record for field investigation activities, as described in the QAPP. Detailed descriptions of the information to be recorded in the field notebooks during site investigation activities as well as presentation of information (including correction of errors) and management of the notebooks is provided in Section 5 of the QAPP.
>
> Driller Logs--The drilling contractor and TRC-EC geologist will maintain boring and well construction logs under direction of the TRC-EC Field Team Leader.

2.2 Sample Management and Tracking

The TRC-EC Project Manager will maintain records of: sample shipments; receipt of analytical results; submittal of preliminary results for QA/QC review; results of the QA/QC review; and evaluation of the QC package from the laboratory. The objective is to ensure only validated data with final approval are used in site analysis.

Preliminary data, clearly identified as such, may be used to prepare internal review documents; to begin data analysis; and to narrow remedial action alternatives. The final Remedial Investigation report, however, will clearly identify all validated data and will be accompanied by a QA/QC discussion and associated data qualifiers.

2.2.1 Sample Identification and Chain-of-Custody

The Field QC Coordinator will coordinate sample analysis with the laboratory. TRC-EC and the laboratory will use standard chain-of-custody procedures for sample tracking which have been approved by EPA (CLP) and the Navy (NEESA). Chain-of-custody procedures are initiated in the laboratory upon sample container shipment to the field and continue with the return shipment of the samples to the laboratory. At the laboratory, a sample custodian continues the chain-of-custody by assigning a laboratory identification number to each sample. This identification number, along with the number assigned in the field, accompanies the sample through analysis, and back to the TRC-EC Project Manager with the analytical results. Chain-of-custody procedures are described in further detail in Section 5 of the QAPP.

2.2.2 Reporting of Analytical Results

Data reporting procedures are described in the CLP analytical Statements of Work (as referenced in the QAPP), in the laboratory's, NEESA-approved QA Manual, and in the QAPP prepared for this project. These procedures yield analytical data in a defined deliverable format. Laboratory data reporting procedures are briefly outlined below.

> Manual Recording--The laboratory's Standard Operating Procedures and CLP protocol describe the QC procedures used for laboratory notebooks and include data worksheets which are routinely used in the reduction of quantitative instrument data to a report format expressed in terms of concentration. Instrumental data are entered on summary worksheets using microcomputers and appropriate software.

> Automated Recording--Many analytical measurements at CLP laboratories are automatically recorded; e.g., complex analytical instruments have their own computerized data systems. Instrument checklists include checks on the operation of these data handlers and internal validity checks are used to flag data resulting from electronic interferences.

Calculation of Results--Whenever possible, laboratory calculations are computerized for efficiency and to avoid human error. The analytical data systems mentioned above calculate results as programmed and provide hard copy in the desired format. Computerized data are verified for error control, and careful handling of computer storage peripherals is stressed. Tests are built into the programs to trap transcription errors or missing items. The record of the run contains the calculation results, and the input data. Analytical results are reduced to the correct number of significant figures for the measurement technique.

Data Review--Acceptance limits are provided to help the operator spot questionable data and control charts are used whenever possible to show if the procedure is in control. The laboratory Quality Control Coordinator initiates control charts for instrument performance and specific analytical methods, and reviews routine and specialized QC sample results as they pertain to each project. In the laboratory, data are reviewed promptly to ensure reasonableness and determine if corrective action is needed.

Data Validation--Data validation is the process of reviewing data and accepting, qualifying, or rejecting it on the basis of sound criteria. A detailed discussion of data validation procedures is provided in Section 8 of the QAPP.

2.3 Document Control

A document inventory and filing system has been established for the NETC-Newport RI/FS and will be maintained during Phase II Melville North Landfill site investigations. The TRC-EC Project Manager will hold responsibility for document control. All originals will be maintained in the central file. Project staff will make copies of documents, as needed, and return the originals. The file will have the capability for locking during non-business hours.

3.0 REMEDIAL INVESTIGATION REPORT

The preparation of the Remedial Investigation Report involves the evaluation of analytical data with respect to existing site conditions (e.g., geology, hydrogeology), previous investigation data and background information. This evaluation provides the basis for the determination of the nature and extent of contamination at a given site as well as contaminant fate and transport analyses. The RI Report will present and assess both Phase I and Phase II RI data.

Initially a draft RI report will be prepared and submitted for review. Upon response to any review comments and approval, the final RI report will be prepared and submitted. A description of the preparation of the Remedial Investigation Report is provided below. An outline of the report format is presented in Table 1. The individual report sections are described below.

3.1 Introduction

The objectives and scope of the Remedial Investigation will be summarized in this section. Background information, including a site description, site history and summary of previous environmental investigations, will also be presented.

3.2 Site Investigations

The various field investigation methodologies will be described. For each type of field investigation activity, background information pertinent to the site investigations will be briefly summarized. An overview of the investigations will be provided, including the number of samples collected and the analytical methods used for sample analysis. Field observations and measurements, such as geophysical readings, visible contamination, observed odors, etc., will also be provided.

3.3 Physical Characteristics

Physical characteristics of the site, including physiography, meteorology, surface water hydrology, geology and hydrogeology, will be presented.

3.4 Nature and Extent of Contamination

This section presents the results of the site characterization. Initially, contaminant comparison levels will be defined for use in discussing the relative degree of environmental contamination within a given medium. The nature of chemical contaminants for each medium sampled at a site will be discussed, based on an evaluation of analytical results. The extent of chemical contamination will be evaluated with respect to sample locations, sample depths and density of sample points.

3.5 Contaminant Fate and Transport

This section evaluates identified contaminants with respect to their chemical characteristics. Chemical characteristics can be used to predict the fate of contaminants within the environment. The persistence of a chemical in a given media will be evaluated and, if determined not to be persistent, potential environmental transport mechanisms and pathways will be identified. This section may be incorporated into the Risk Assessment discussion.

3.6 Risk Assessment

The Risk Assessment will consist of an Ecological and Human Health Evaluation, as described in Volumes V and VI of this Work Plan.

3.7 Summary and Conclusions

The RI Report summary and conclusions will provide a summary of the nature and extent of contamination, contaminant fate and transport mechanisms and potential risks to human health and the environment posed by the site. Conclusions will consist of a discussion of data limitations and their impact on the site characterization, recommendations for additional site investigations, if any, and recommended remedial action objectives, which will lead into the Feasibility Study process.

TABLES

TABLE 1

PLANNED FORMAT FOR RI REPORT FOR NETC-NEWPORT

Executive Summary

1. Introduction
    - 1.1 Objective and Scope
    - 1.2 NETC Background
        - 1.2.1 NETC Description
        - 1.2.2 NETC History
        - 1.2.3 Historic Map/Aerial Summary
    - 1.3 Site Background
        - 1.3.1 Site Description
        - 1.3.2 Site History
        - 1.3.3 Previous Investigations
    - 1.4 Report Organization

2. Site Investigations

    (Includes field activities associated with site characterization on a site-by-site basis. These may include physical and chemical monitoring of some, but not necessarily all, of the following):

    - 2.1 Ambient Air and Radiological Investigations
    - 2.2 Geophysical Investigations
    - 2.3 Soil Gas Investigations
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(continued)

PLANNED FORMAT FOR RI REPORT FOR NETC-NEWPORT

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(Includes results of field activities to determine physical characteristics. These may include some, but not necessarily all, of the following):

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   3.3 Surface Water Hydrology
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   3.5 Hydrogeology
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   3.7 Ecology

4. Nature and Extent of Contamination at Each Site
(Presents the results of site characterization, including both natural chemical components and contaminants in some, but not necessarily all, of the following media):

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B. Previous Investigations Information
C. Analytical Data and QA/QC Evaluation Results
D. Risk Assessment Methods

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

VOLUME V
RISK ASSESSMENT PLAN-
HUMAN HEALTH EVALUATION

PHASE II RI/FS WORK PLAN

SITE 02 - MELVILLE NORTH LANDFILL

NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

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TRC-EC Project No. 6760-N81-110
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1.0 INTRODUCTION

This document briefly describes the work completed to date and the additional work that will be carried out as part of the Human Health Evaluation portion of the Risk Assessment for the Melville North Landfill on the Naval Education and Training Center in Newport, Rhode Island (NETC-Newport). The Ecological Evaluation portion of the Risk Assessment is addressed in Volume VI of this Work Plan.

1.1 Objectives

The overall objective of the Human Health Evaluation is to provide a quantitative and qualitative assessment of the risks associated with current and potential future uses of a site. It takes into consideration chemical contaminants in soil, ground water, surface water, sediments and other media to which humans could be exposed for which chemical data have been developed. The Human Health Evaluation is used to determine the need for remedial action at a site. It also provides a basis for determining the levels of chemicals that can remain on-site and still be adequately protective of human health.

The specific objectives of the Human Health Evaluation for the Melville North Landfill facility are to:

- Identify potential receptors, based on current site use as well as potential future site use;
- Identify the potential pathways and routes by which humans may be exposed to the identified contaminants;
- Measure or estimate exposure point concentrations;
- Examine fate and transport processes of contaminants in environmental media;
- Gather information on the toxic effects of the chemicals;
- Characterize the human health risks associated with exposures under current and future conditions;
- Assess the uncertainties associated with the risk estimates; and
- Discuss the significance of the findings.

1.2 Methodology

The Human Health Evaluation will be prepared in accordance with the following documents:

U.S. Environmental Protection Agency, 1989, "Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Volume I, Part A"; Office of Solid Waste and Emergency Response; 9285.701A; July 1989.

U.S. Environmental Protection Agency, 1989, "Region I, Supplemental Risk Assessment Guidance for the Superfund Program, Part 1,2"; EPA/901/5-89-001; June 1989.

U.S. Environmental Protection Agency, 1991, "Human Health Evaluation Manual, Supplemental Guidance: 'Standard Default Exposure Factors'". EPA OSWER Directive 9285.6-03, March, 1991.

U.S. Environmental Protection Agency, 1990, "Guidance for Data Useability in Risk Assessment", Interim Final. EPA/540/G-90/008, October, 1990.

Human Health Evaluations will be prepared for the Melville North Landfill site on the basis of Phase I and Phase II environmental data.

The Human Health Assessment Plan is organized in accordance with the following Human Health Assessment tasks:

Data Collection and Evaluation
Exposure Assessment
Toxicity Assessment
Risk Characterization
Uncertainty Assessment

Prior to discussing the individual project tasks, a summary of background information and previous Human Health Assessment activities is provided. A proposed outline for a Human Health Assessment Report is provided in Table 1. The Human Health Assessment Report and Ecological Evaluation Report will be incorporated into the Phase II Remedial Investigation Report, as described in Volume IV of this Work Plan.

1.3 Background and Site Description

1.3.1 Introduction

The NETC site is approximately 1,063 acres in size, with portions of the facility located in Newport, Middletown, and Portsmouth, Rhode Island. The site is approximately 60 miles south of Boston and 25 miles southeast of Providence. The facility layout is long and narrow, following the shoreline of Aquidneck Island for nearly 6 miles bordering Narragansett Bay. A site location map is provided on Figure 1.

The NETC facility area has been used by the US Navy since the era of the Civil War. Portions of the facility are currently leased by the Navy to the State of Rhode Island and Economic Development Corporation. Some of these areas are subleased to private enterprises.

Previous environmental investigations at the NETC facility include the performance of an Initial Assessment Study (IAS) by Envirodyne Engineers, Inc. (EEI) in 1982 and 1983, and a Confirmation Study (CS), consisting of a Verification Step and Characterization Step, by Loureiro Engineering Associates (Loureiro) over the period from 1983 to 1986. The IAS, which consisted of a background investigation and site visits, was conducted at five NETC sites, including the Melville North Landfill. The CS, which involved environmental sample collection and analysis, was conducted for the Melville North Landfill and two other NETC sites. The investigation of the Melville North Landfill site is addressed under this Work Plan. The following other four NETC RI/FS sites are being addressed under a separate investigation Work Plan: Site 01-McAllister Point Landfill, Site 09-Old Fire Fighting Training Area, Site 12-Tank Farm Four, and Site 13-Tank Farm Five.

1.3.2 Site Description

Descriptions of the individual sites are provided in Section 2. A general discussion of regional geology, hydrogeology, and hydrology is presented below.

The NETC is located at the southeastern end of the Narragansett Basin. The rocks of the Narragansett Basin are non-marine sedimentary rocks of Pennsylvanian age. The bedrock at the NETC facility is almost entirely of the Rhode Island Formation. Within the Rhode Island Formation, there are a few areas of thick conglomerates. They consist of pebbles, cobbles, and boulders interbedded with sandstone and graywacke. Coasters Harbor Island of NETC is mostly covered with this conglomerate material. Overlying the Pennsylvanian rocks of the Narragansett Basin are surficial deposits of Pleistocene sediments. These unconsolidated, glacial sediments range in thickness from 1 to 150 feet and consist of till, sand, gravel and silt.

Many areas on Aquidneck Island, on which the NETC is located, obtain potable water supply from wells. Ground water is obtained from the unconsolidated glacial till deposits and from the underlying Pennsylvanian bedrock. The average depth to ground water is 14 feet. In the NETC area, glacial till deposits are typically less than 20 feet in thickness. Well yields in these materials range from 1 to 120 gallons per minute. Bedrock well yields range from less than 1 to as much as 55 gallons per minute and are highly dependent on the presence of joints and fractures. Most ground water is soft or moderately hard. In scattered locations, pumping has led to salt water intrusion. No wells were identified within the boundaries of NETC other than on Gould Island.

The NETC facility is located within the Narragansett Bay drainage basin. All surface water drainage from the basin is into Narragansett Bay. Throughout the majority of the facility surface drainage is toward Narragansett Bay, with drainage provided by several brooks and streams.

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

2.1 Data Collection and Evaluation

Data Collection and Evaluation involves the gathering of site data and its analysis relevant to human health. Both Phase I and Phase II analytical data will be used in conducting the Human Health Assessments. This data will be evaluated to determine the applicability of the various analytical methods used in preparing the Human Health Assessment. Evaluation activities will include a review of the following in accordance with EPA's guidance document "Guidance for Data Useability in Risk Assessment":

Analytical methods used;
Quantitation and detection limits;
Qualified and coded data;
Blank concentrations;
Tentatively identified compounds; and
Background sample results.

TRC-EC will also incorporate EPA's comments regarding data collection and the evaluation process in the Phase I RI to the Phase II Risk Assessment. Volume III of the Phase II RI/FS Workplan, NETC-Newport, RI Field Sampling Plan discusses the proposed sampling and analytical program to be conducted in Phase II. Upon completion of the data evaluation, a list of chemicals of potential concern by medium will be developed for use in the quantitative risk assessment. Based on guidance criteria presented in "Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Volume I, Part A", the number of chemicals to be carried through the risk assessment may be reduced at this point.

A review of Phase I analytical data and the scope of Phase II field investigations has been conducted to ensure the adequate characterization of the Melville North Landfill site with respect to Human Health Evaluation assessment. Background samples have been included in the Phase II Field Sampling Plan (Volume III), for both surface soil and ground water. These background samples will be used in the Human Health Evaluation as reference points for comparison to site contamination levels and as indicators of naturally occurring conditions.

A summary of the results of the Phase I Risk Assessment data collection and evaluation task for the Melville North Landfill site is presented below.

2.1.1 Site 02 - Melville North Landfill

- Site Description

The Melville North Landfill is located at the northern end of the NETC facility. The site is approximately 8 acres in size and is located between Defense Highway and Narragansett Bay. The site is generally flat across the central to northern portions, with a ridge running along the eastern side of the southern portion of the site. An oily soil/waste pile area is located at the northern end of the site. The grade along the western edge of the site is nearly level with the shoreline. Elevations increase in the easterly direction. The site is covered with grass, weeds and small trees, with more mature wooded areas in the southern portion of the site. A marshy area lies along the northern edge of the site. The Melville North Landfill was operated as a landfill following World War II until 1955. Reportedly wastes similar to those received at McAllister Point Landfill were disposed of at Melville North Landfill, including spent acids, paints, oils, and, potentially, PCBs. Oil-soaked soil appears to have been dumped on the surface in the northern portion of the site. The site was excessed by the Navy, and the planned future use of the site is as a marina. A site map is provided on Figure 3.

Previous Environmental Investigations

The CS at this site involved the collection of sediment and mussel samples and a composite soil sample from a mound of oil-saturated soils, and the excavation of test pits to determine the depth of oil-contaminated soils. The soil sample collected from the oily waste deposits contained over 3% petroleum hydrocarbons by weight, as well as an elevated level of lead. Based on the test pit activities, no lateral or downward migration of oil from the waste deposits is evident. Metals levels detected in sediment samples and PCB levels detected in mussel samples appeared to be similar to background levels and not attributable to site-specific contamination.

Field Investigation Areas and Scope

Areas of potential concern investigated at this site include the historic landfill areas, areas of surficial oily deposits and previous lagoon sites, as identified through historic aerial photo review. Site sample locations are provided on Figure 3.

Phase I - Field Investigation Findings Summary

Soil Assessment - Volatile organic compounds (VOCs), base beutral/acid extractable organic compounds (BNAs), pesticides, polychlorinated biphenyls (PCBs), and inorganics were all detected in on-site soils. The major areas of the site where contaminants were detected in the soils at elevated levels including the following:

Northwestern area - BNAs, PCBs;
Northeastern area - PCBs, inorganics;
North-central area - inorganics;
Central area - VOCs, BNAs, pesticides, PCBs and inorganics; and
South of access road - VOCs, BNAs, PCBs, and inorganics.

Significant VOC contamination (i.e., greater than 1 ppm total VOCs) was detected in subsurface soils in the central portion of the site, in the suspected area of former lagoons, and in the southern portion of the site at well boring 4. Soil samples collected in the former lagoon area and from well boring 4 generally exhibited strong petroleum odors and/or visible oil contamination. BNAs were detected at elevated levels (i.e., greater than 10 ppm total BNAs) in the northwest, central and southern portions of the site. Pesticides were detected at low levels (i.e., 10's of ppb) in surface soil samples across the site with higher levels (100's of ppb) detected in the central portion of the site. PCBs were detected in surface and subsurface soils. PCBs were detected above the 1 ppm RIDEM PCB soil action level in surface soils in the northwest and northeast portions of the site, and in subsurface soils in the central and southern portions of the site. Inorganics were detected in soil samples collected from the northeast corner of the site to just south of the site access road at levels exceeding background levels. The highest inorganic levels were detected in subsurface soils generally collected at or below the water table from the north-central and central to south-central portions of the site.

Ground Water Assessment - VOCs, BNAs, pesticides, PCBs, and inorganics were all detected in ground water samples. The major areas of the site where contaminants were detected at levels exceeding action levels include the following:

North-central area - inorganics;
Central area - VOCs, and inorganics; and
South of access road - VOCs, BNAs and PCBs.

VOC detections at concentrations exceeding ground water action levels, consisting mostly of petroleum-related VOCs (xylene, benzene), were limited to wells located in the central (MW-3) and southern (MW-4) portions of the site. Oil was identified in well MW-3. VOCs were also detected in soil boring samples collected at the depth of the water table from the central and southern portions of the site, and signs of petroleum related contamination (e.g., odors, oil) were observed during the drilling and sampling of these borings. One BNA compound was detected above ground water action levels in a well (MW-4) in the southern portion of the site. A pesticide, gamma-BHC, was detected in ground water at well MW-4. A PCB concentration of 40 ppb was also detected in well MW-4 (PCBs were detected in the soil from this well boring). PCBs were also detected at 0.13 ppb, less than the MCL, in MW-3 in the central portion of the site. While inorganic concentrations exceeded ground water action levels in most wells, the highest levels of inorganic analytes were detected in ground water in the central to north-central portions of the site.

Sediment Sample Assessment - VOCs, BNAs, pesticides, and inorganics were detected in sediment samples. The sediment samples were collected from the swampy area at the northern edge of the site. The contaminants detected at elevated levels in the sediment include the CaPAHs, pesticides and inorganics.

The maximum total VOC concentration detected in the sediment was 11 ppb, well below the contaminant-comparison level of 1 ppm. The maximum total BNA concentration detected was 5.43 ppm, also below the contaminant-comparison level of 10 ppm. However, total carcinogenic PAH levels in two samples exceeded the contaminant-comparison level of 1 ppm. Pesticides were detected in each of the sediment samples, with 4,4'-DDE detected at each location at concentrations ranging from 7.9 to 470 ppb. Inorganic analytes were detected at elevated concentrations at each sample location, although different analytes exceeded background at each location.

Human Health Assessment

The exposure scenarios considered in the evaluation of the Melville North Landfill site included a trespassing/current use scenario, a construction/future use scenario, an industrial/future use scenario, and a residential/future use scenario. The estimated risks, in terms of cancer risk (carcinogenic) and hazard risk (non-carcinogenic) estimates associated with each scenario evaluated and the exposure pathway(s) driving the calculated risks are summarized below:

- Trespassing Scenario (Scenario 1) - Total cancer risk range and total hazard index ratio range are within target values.

  Construction Scenario (Scenario 2) - The total cancer risk range and the mean hazard index ratio are within target values. The maximum hazard index ratio exceeded the target value.

  Commercial/Industrial Use Scenario (Scenario 3) - The total cancer risk range and the hazard index ratio range exceed target values.

- Residential Use Scenario (Scenario 4) - The total cancer risk range and the hazard index ratio range exceed target values for both children and adult receptors.

For Scenarios 1 and 2, the major contributing factor to the calculation of cancer risk is ingestion of arsenic and carcinogenic PAHs in soil. The pathway of primary concern associated with Scenarios 3 and 4 with respect to cancer risk is ingestion of ground water containing chlorinated VOCs (1,1-dichloroethene, vinyl chloride and trichloroethene, which are completely based on qualified data) and inorganics (arsenic, beryllium). Ingestion of arsenic and PAHs in soil and inhalation of VOCs also are important exposure pathways in the residential use scenario with respect to cancer risks.

The primary contributor to the total hazard index ratio for Scenarios 1 and 2 is ingestion of inorganics (antimony, copper) in soil. Ingestion of inorganics (mercury, thallium) in ground water drove the total hazard index ratio for Scenarios 3 and 4. Other pathways of concern specifically applicable to exposure of children in the residential use scenario are ingestion of chemicals in soil and inhalation of vapor phase VOCs.

3.0 CONTAMINANT FATE AND TRANSPORT

This section of the risk assessment will re-evaluate the fate and transport of contaminants as described in Phase I and provide an indication of future contaminant movement.

3.1 Potential Routes of Migration

To determine the fate of contaminants of potential concern at the Melville North Landfill site, information on the physical/chemical and environmental fate properties provided in Phase I will be updated when appropriate. Evaluation of off-site migration pathways will also be provided.

3.2 Contaminant Distribution and Observed Migration

This section of the contaminant fate and transport analysis will examine the presence of contaminants across the site in combination with migration pathways to provide an understanding of contaminant persistence and migration at the site.

4.0 EXPOSURE ASSESSMENT

4.1 Development of Exposure Scenarios (General)

The Exposure Assessment initially involves the characterization of the exposure setting of the site, including the physical environment and the potentially exposed populations. Exposure pathways are then identified. Included in this assessment is a consideration of both existing and potential future exposure scenarios based on current and potential future land use. Contaminant sources, receiving media, the fate and transport of the contaminants within the receiving media, and exposure points and exposure routes are evaluated and the information integrated in the development of potential exposure scenarios. Exposure concentrations are estimated for the various media included in the potential exposure pathways. Chemical intakes are estimated by exposure medium and exposure route based on equations provided in the guidance documents.

4.2 Exposure Scenarios Addressed in the Health Assessment

Based on information contained within the Phase I Risk Assessment document, potentials for human exposure exist via the following media:

surface soils;
subsurface soils;
ground water;
sediments;
air; and
shellfish.

Surface and subsurface soil exposure pathways at the Melville North Landfill site are limited to direct contact exposures (dermal exposure and incidental soil ingestion). Ground water exposures are limited by the absence of drinking water wells at the NETC-Newport facility. Off-site potable wells have not been identified in areas thought to be downgradient of the NETC-Newport sites.

While ground water does not pose a current exposure pathway, potential future residential use of the ground water will be considered where ground water data has been collected during either Phase I or II investigations and where the designated best beneficial use of the ground water is as a drinking water source.

Sediments samples were collected during the Phase I RI. Exposure to these media were evaluated on a site-specific basis. A similar approach will be used in the Phase II Human Health Evaluation. Sampling of adjacent surface water bodies will be conducted during the Site Remedial Investigations. The analytical results will be reviewed for potential inclusion in the Phase II Human Health Evaluation exposure scenarios.

No extensive air sampling will be conducted during the Phase II RI. The presence of vegetation over most of the areas under investigation limit potential exposures to wind-blown particles and the length of time wastes have been in-place minimize potential contaminant volatilization. Exposure to contamination during future excavation activities will be considered through modeling exercises, if appropriate to the evaluated future site uses. Also indoor air will be evaluated with respect to dust or volatilization of contaminants during bathing, showering or cooking, if applicable under future site use scenarios.

Exposure to contaminants via shellfish ingestion was not evaluated in the Phase I Risk Assessment. The potential for exposure to contaminated shellfish will be reevaluated within this assessment. Bivalves will be collected from the adjacent Narragansett Bay to determine tissue burden, while modeled bioconcentration will be determined for fish and lobster. This information will be available for use in the Human Health Evaluation to establish exposures to contaminants in shellfish.

Potential receptors will be identified on the basis of current site use, surrounding land use, the presence or absence of site access restrictions and/or field observations of site use. Potential future receptors will be identified on the basis of future land use expectations. The expansion of residential development onto site property will be considered.

The following potential routes of exposure will be evaluated to determine their applicability to the site under investigation and the associated exposure scenarios:

Dermal contact with soil/sediments;
Incidental ingestion of soil/sediments;
Dermal contact with surface water;
Incidental ingestion of surface water;
Ingestion of ground water;
Inhalation of airborne (vapor phase) contaminants;
Inhalation of particulate phase contaminants; and
Ingestion of contaminated shellfish.

Exposure scenarios will be developed on a site-specific basis. Typical scenarios which are considered include current site use/base worker; current site use/trespasser; future site use/construction; future site use/industrial; future site use/residential. Receptors will be identified for each scenario (e.g., current site use/base worker would consider adult receptors; future site use/residential would consider adult and child receptors). Exposure parameters will be based on EPA Region I Risk Assessment Guidance in combination with site-specific exposure considerations.

4.3 Estimating Environmental Concentrations

All exposure point concentrations used to assess receptor dose will be calculated as specified in "Supplemental Risk Assessment Guidance for the Superfund Program, Part 1 and 2" (EPA/901/5-89-001; June 1989). Specifically, the exposure point concentration will be calculated using the geometric or arithmetic mean method, depending on the distribution of site data.

4.4 Evaluating Uncertainty

Uncertainty associated with contaminant concentrations, exposure point concentrations and exposure assumptions will be discussed. The exposure estimates for each receptor in each scenario will be based on numerous variables with varying degrees of uncertainty. This discussion will focus on these parameters and the associated range of uncertainty.

5.0 TOXICITY ASSESSMENT

Conducted simultaneously with the Exposure Assessment, the Toxicity Assessment evaluates the toxicity of the chemicals of concern through hazard identification and dose-response evaluation. Hazard identification is the process of determining if exposure to a chemical can cause an increase in the incidence of a particular adverse effect (e.g., cancer) and whether the adverse effect is likely to occur in humans. EPA uses a dose-response evaluation to derive toxicity values. This evaluation is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant and the incidence of adverse health effects in the exposed population. This evaluation allows the derivation of toxicity values (e.g., reference doses and slope factors) that can be used to estimate the incidence or potential for adverse health effects as a function of human exposure.

Toxicity information will be obtained from scientific literature and EPA's Integrated Risk Information (IRIS) on-line data base. Health criteria will be obtained from the following sources, listed in descending order of use:

- IRIS;
- Health Effects Assessment Summary Tables;
- EPA Criteria Documents;
- Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles; and
- Communication with EPA's Environmental Criteria and Assessment Office (ECAO) via EPA Region I Risk Assessment contact.

5.1 Carcinogenic Effects

Carcinogenic human health risks will be estimated using the slope factor (or cancer potency factor), if available, for each contaminant of concern. The slope factor is generally defined as the upper 95 percent confidence limit of the slope of the dose-response curve and is the result of the application of a low-dose extrapolation procedure. A no threshold linear dose-response model is assumed. Certain compounds, such as PAHs and PCBs, may be grouped together for evaluating health risks. This method assumes that the carcinogenic effects are additive and that structurally similar compounds have the same potency.

5.2 Noncarcinogenic Effects

Noncarcinogenic human health risks will be evaluated by analyzing long-term (chronic) exposures to the contaminants of concern. For long-term exposures, the chronic or subchronic reference dose (RfD) is used. An example of an exposure utilizing a subchronic RfD is future construction or development of the site. Workers are expected to be exposed for less than a six year period. The reference dose is defined as an estimate of a daily exposure concentration for the human population over a lifetime, including sensitive subpopulations, that is likely to be without an adverse health effect. The RfD is commonly derived from the No Observable Adverse Effects Level (NOAEL) or the Lowest Observable Adverse Effects Level (LOAEL). No dermal RfDs currently exist, therefore, for dermal exposure calculations, oral RfDs will be applied, when appropriate.

5.3 Toxicity Information

For each of the COCs, a brief summary of the known toxic effects will be presented. These summaries will include the effects associated with exposure to the chemical and the concentrations at which adverse effects are expected to occur in humans, if available. Additional information will also be presented, including but not limited to the following: the chemical and physical properties of the chemical; fate and transport characteristics; and a discussion of critical studies which describe the noncarcinogenic and carcinogenic effects of the chemical.

6.0 RISK CHARACTERIZATION

Risk Characterization integrates all information previously developed in the Human Health Evaluation to characterize potential risks posed by the site. The exposure pathways are evaluated with respect to the toxicity information and pathway risks are quantified for each substance and are totalled for each pathway. Based on available toxicity and exposure information, cancer risks and noncancer hazard quotients are estimated. Risks are combined across pathways to estimate the total risk posed to a receptor over a given time period. Because there are many uncertainties involved in the estimation of cancer and non-cancer risks, an assessment of site-specific factors and toxicity factors which contribute to the uncertainty of the evaluation is presented.

6.1 Quantitative Risk Assessment

Carcinogenic Risk

The incremental carcinogenic risk associated with exposure to a given contaminant will be calculated by multiplying the slope factor by the dose. Cancer risk is unitless and is expressed in scientific notation. For example, a risk of 1E-06 indicates that an individual has one chance in 1,000,000 of developing cancer over a lifetime.

Incremental carcinogenic risks will be calculated for each contaminant of concern and exposure pathway. Risk values will be summed by pathway to provide total pathway-specific risks. Risk estimates will be compared against the NCP's cleanup goal for Superfund sites, set at a target risk range of 1E-04 to 1E-06.

Noncarcinogenic Risks

Potential noncarcinogenic effects are expressed as the Hazard Index, the ratio of the exposure dose to the reference dose. A Hazard Index that exceeds unity suggests a greater likelihood of developing an adverse effect.

Hazard quotients will be calculated for each contaminant and will then be summed to provide an indication of the pathway-specific exposure hazard. If hazard indices exceed unity, contaminants will be grouped by target organ (systemic effect) to further analyze potential for an adverse effect.

6.2 Qualitative Analysis of Risks

Selected compounds will be addressed qualitatively rather than quantitatively because these compounds lack cancer slope factors or RfD values. The potential impact associated with the omission of these compounds from the quantitative risk assessment will be discussed.

6.3 Uncertainty Assessment

Uncertainties associated with the risk characterization may include uncertainty surrounding cancer or non-cancer risk. Site-specific factors might include uncertainty associated with conditional land usage, activity patterns or exclusion of contaminants from the risk assessment. For the risk estimation of cancer and of chronic non-cancer health effects, risk are summated across pathways to yield total pathway risk. This may well be a conservative approach, since, in general, different chemicals do not have the same target organ or mechanism of action. This uncertainty will be provided in the Phase II risk assessment.

7.0 UNCERTAINTIES/LIMITATIONS

Uncertainties and/or limitations inherent in the risk assessment will be presented in the Phase II assessment. Potential areas of uncertainty include, but may not be limited to:

- Site specific uncertainty. Site-specific factors might include uncertainty associated with conditional land usage, activity patterns or exclusion of contaminants from the risk assessment.

- Uncertainty in the derivation of toxicity factors. In numerous cases in which a toxicity value is available for one exposure route but not another, a dose route extrapolation will be performed, leading to a source of uncertainty in the risk characterization.

TABLES

TABLE 1

PLANNED HUMAN HEALTH ASSESSMENT REPORT FORMAT
SITE 02 - MELVILLE NORTH LANDFILL
NETC - NEWPORT

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3.0 Contaminant Fate and Transport
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6.0 Risk Characterization
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- 6.3 Uncertainty Assessment

7.0 Uncertainties/Limitations

8.0 References

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B. Toxicological Profiles
C. Physical/Chemical and Environmental Fate Properties

TABLE 2

SITE 02 - PHASE I

CONTAMINANTS OF CONCERN

SOIL

Volatiles

Semivolatiles

Carcinogenic PAHs

Inorganics

Antimony
Aresnic
Beryllium
Copper

PCBs

Aroclor - 1260

GROUND WATER

Volatiles

Benzene
Bromodichlormethane
Carbon Tetrachloride
Chloromethane
Dibromochloromethane
1,1-Dichloroethene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichloropropene
Ethylbenzene
Styrene
Tetrachloroethene
1,1,2-Trichloroethane
1,1,2,2-Trichloroethane
Trichloroethene
Vinyl Chloride

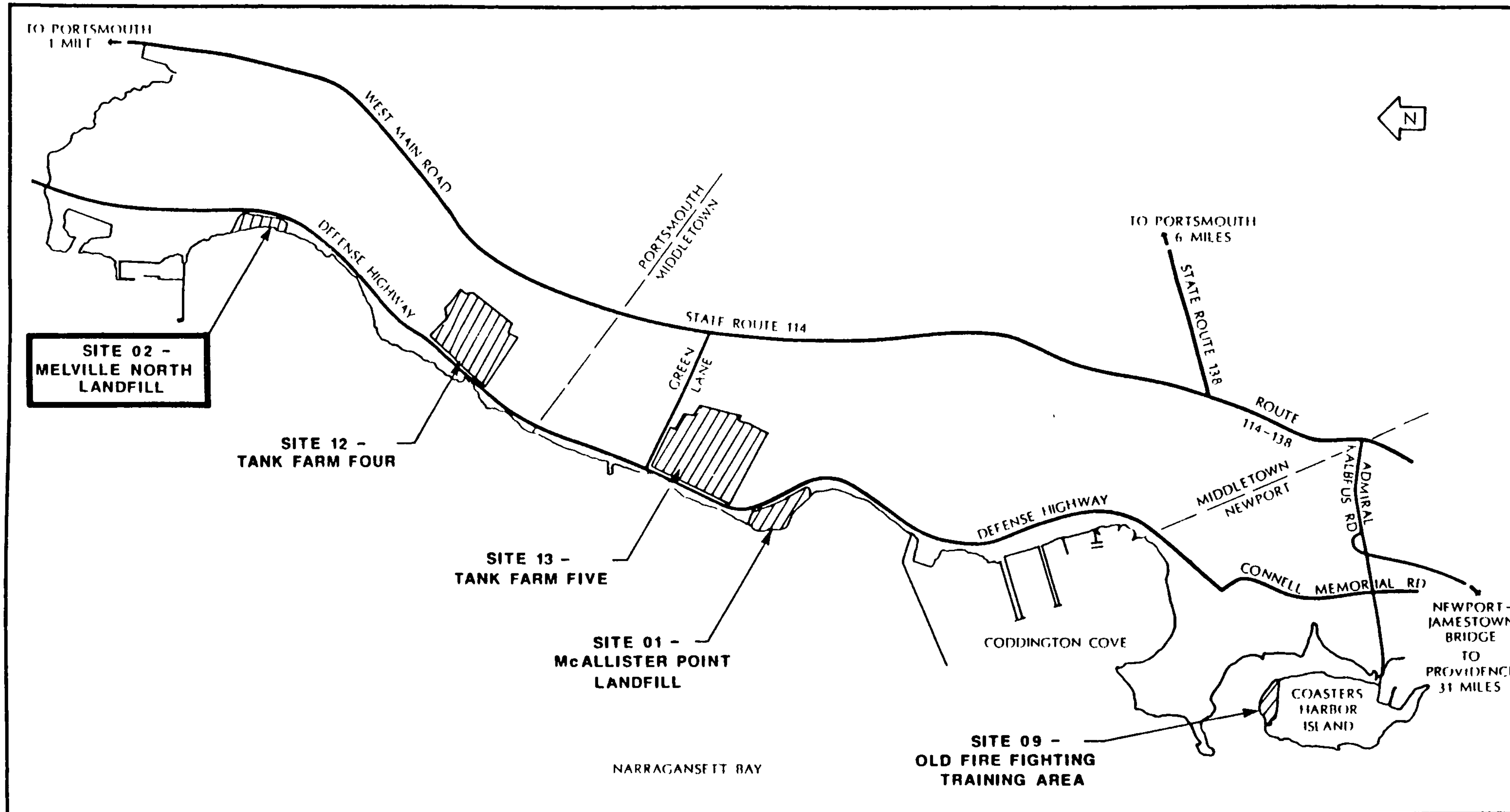
Semivolatiles

Acenapthene

Inorganics

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Copper
Mercury
Thallium
Vanadium
Zinc

FIGURES



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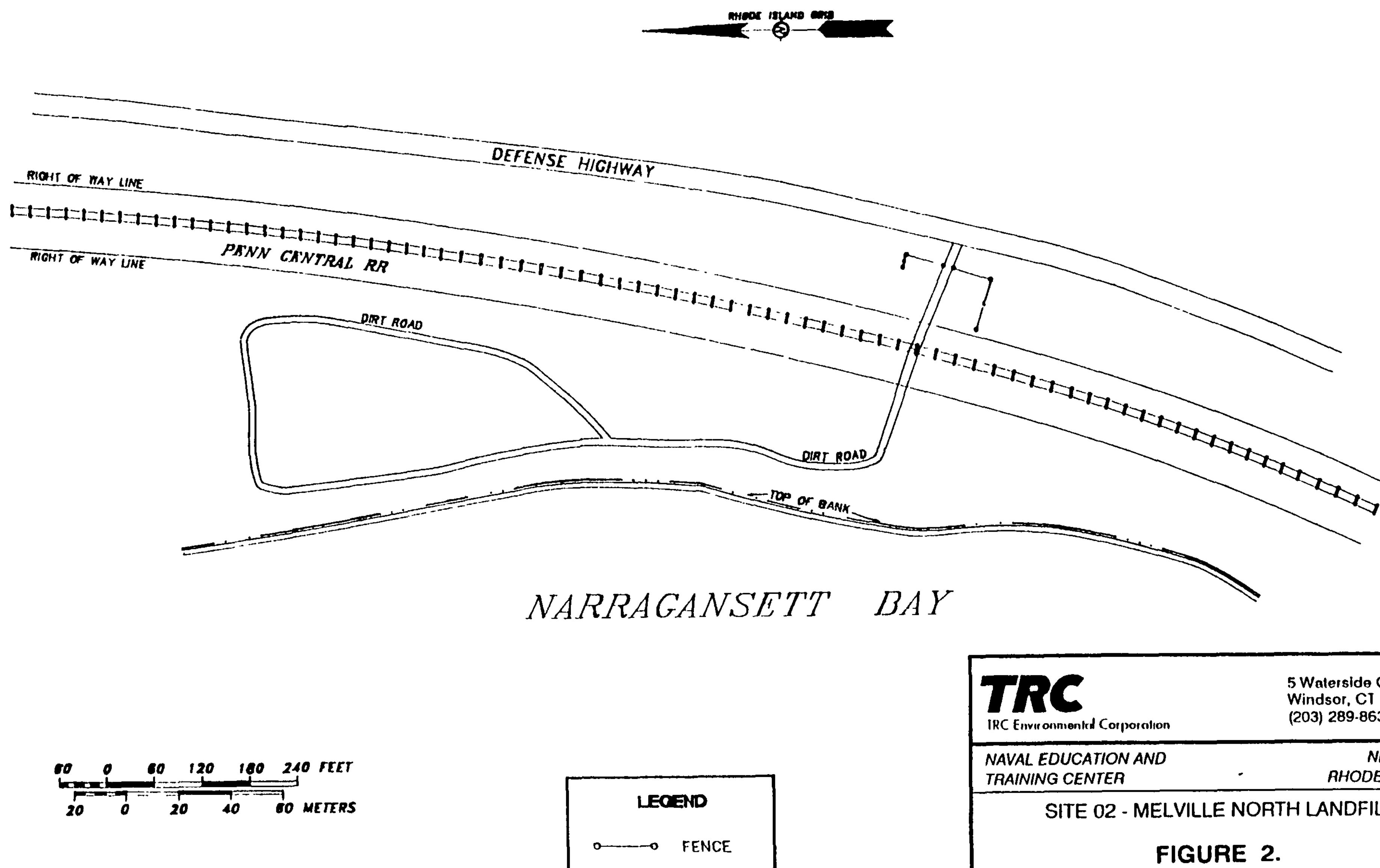
TRC Environmental Corporation
5 Waterside Crossing
Windsor, CT 06095
(203) 289 8631

NAVAL EDUCATION AND TRAINING CENTER | NEWPORT RHODE ISLAND

FIGURE 1.

NETC SITE LOCATION MAP

Date 9/92 | Drawing No 6760 N81



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(203) 289-8631

NAVAL EDUCATION AND TRAINING CENTER — *NEWPORT RHODE ISLAND*

SITE 02 - MELVILLE NORTH LANDFILL

FIGURE 2.
SITE MAP

Date: 9/92	Drawing No 6760-N81

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

VOLUME VII
ARARs AND PRELIMINARY REMEDIAL ACTION ALTERNATIVES

PHASE II RI/FS WORK PLAN
SITE 02 - MELVILLE NORTH LANDFILL
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared For:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

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1.0 INTRODUCTION

A preliminary identification of potential Applicable or Relevant and Appropriate Requirements (ARARs) in the scoping phase can assist in the initial identification of remedial alternatives and in the identification of additional data needs. This document provides a preliminary assessment of ARARs as they apply to the NETC-Newport sites and provides a preliminary identification of potential remedial action alternatives. The Feasibility Study process, which will build upon this information, is discussed in detail in Volume VIII.

2.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS(ARARs)

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA, 1986), and the NCP (1990) require that all remedial response actions attain or exceed applicable or relevant and appropriate requirements of Federal and more stringent promulgated requirements of State environmental statute(s). The NCP defines applicable requirements as "those cleanup standards, standards of control, other substantive environmental protection requirements, criteria or limitations promulgated under federal environmental or state environmental facility siting law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." Relevant and appropriate requirements are defined in the NCP as "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at the CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site."

Current EPA CERCLA guidance calls for a preliminary identification of potential ARARs during the RI scoping phase to assist in initial identification of remedial alternatives. Early identification also facilitates communications with support agencies to evaluate ARARs, and may help planning of field activities. Because of the iterative nature of the RI/FS process, ARAR identification continues throughout the RI/FS as better understanding is gained of the site conditions, site contaminants, and remedial action alternatives. Findings of the Phase I RI have aided in the selection of ARARs identified within this document.

ARARs may be categorized as: 1) ambient or chemical-specific requirements, which may define acceptable exposure levels and, therefore, be used in establishing preliminary cleanup goals; 2) location-specific, which may set restrictions on activities within specific locations such as floodplains or wetlands; and 3) performance, design or other action-specific requirements, which may set controls or restrictions for particular treatment and disposal activities related to the management of hazardous wastes. The documents, "CERCLA Compliance With Other Laws Manual" (U.S. EPA, 1988), and "CERCLA Compliance with Other Laws Manual: Part II.

Clean Air Act and Other Environmental Statutes and State Requirements" (U.S. EPA, 1989), contain detailed information on identifying and complying with ARARs.

Preliminary lists of Federal and State of Rhode Island ARARs have been compiled for NETC-Newport, as presented in Tables 1 through 6. Refinement of ARARs will continue throughout the RI/FS.

To-Be-Considered Materials (TBCs) are non-promulgated advisories or guidance issued by Federal or State government that are not legally binding and do not have the status of potential ARARs. However, in many circumstances TBCs will be considered along with ARARs as part of the site risk assessment and may be used in determining the necessary level of cleanup for protection of health or the environment.

3.0 PRELIMINARY REMEDIAL ACTION ALTERNATIVES

EPA's CERCLA guidance calls for the identification of potential remedial action objectives for each contaminated medium. Candidate technologies are also identified to help ensure data needed to conduct the technical evaluation of the technologies can be collected as early as possible during RI activities. Early identification of potential technologies also helps determine whether treatability studies will be required. The approach to conducting a Feasibility Study is discussed in Volume VIII. A list of general response actions appears in Table 7.

EPA guidance calls for identifying a range of remedial alternatives which address site cleanup to varying degrees and meet the criteria set forth in the NCP for the types of remedial alternatives which must be considered. These criteria include the following:

> For alternatives which provide control of the source of contamination, the range of alternatives should include the following:
>
> - A range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substance is a principle element. This range should include an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing the need for long-term management.
> - One or more alternatives that involve little or no treatment, but provide protection of human health and the environment primarily by preventing or controlling exposure to hazardous substances through engineering controls and/or institutional control.
> - For ground water response actions, a limited number of remedial alternatives should be developed that attain site-specific remediation levels within different restoration time periods utilizing one or more different technologies.
> - The development of one or more innovative treatment technologies for further consideration.
> - The no action alternative.

Based on an evaluation of site-specific problems and the proposed cleanup criteria, master lists of potentially feasible remedial technologies have been developed for soil/sediment and ground water, as presented in Tables 8 and 9. The cleanup methods include both on-site and off-site remedies and include treatment technologies to permanently reduce toxicity, mobility, and volume to the maximum extent practicable.

TABLES

TABLE 1
PRELIMINARY IDENTIFICATION OF FEDERAL CHEMICAL–SPECIFIC ARARs AND TBCs
NETC – NEWPORT

FEDERAL STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Ground Water– –			
Safe Drinking Water Act (40 CFR 141.11–.16)	Max Contaminant Levels (MCL's)	MCL's directly apply to "public water systems", defined as systems with at least 15 connections which service a minimum of 25 persons.	ARARs due to presence of contaminants in ground water.
	Lifetime Health Advisories	Guidelines developed based on toxicity for non–carcinogenic compounds	TBC criteria due to the presence of contaminants in ground water.
Surface Water – –			
Clean Water Act (Section 304)	Ambient Water Quality Criteria (AWQC)	Non–enforceable guidelines established for the protection of human health and/or aquatic organisms.	TBC criteria due to the presence of contamination in surface water and sediments. May affect remedial actions involving discharge to surface water.
Clean Water Act (40 CFR 401.15)	Effluent Discharge Limitations	Regulates the discharge of contaminants from an industrial point source.	Potential ARARs for remedial alternatives involving discharge to area surface waters.
Air– –			
Clean Air Act (40 CFR 50)	National Ambient Air Quality Stardards (NAAQS)	Establishes maximum concentrations for particulates and fugitive dust emissions.	Potential ARARs for alternatives involving remedial actions which impact ambient air.
Clean Air Act (40 CFR 60)	New Source Performance Standards (NSPS)	Establishes emissions limitations for new sources.	Potential ARARs for alternatives involving treatment actions which emit pollutants.
Clean Air Act (40 CFR 61)	Emissions Standards for Hazardous Air Pollutants (NESHAPS)	Establishes emissions limitations for hazardous air pollutants.	Potential ARARs for alternatives involving treatment actions which emit hazardous air pollutants.

TABLE 2
PRELIMINARY IDENTIFICATION OF STATE CHEMICAL-SPECIFIC ARARs AND TBCs
NETC - NEWPORT

STATE STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
RI Ground Water Protection Act (RIGL, Title 46, Chapter 13)	Public Drinking Water Regulations	Establishes provisions for the protection and management of potable drinking waters, including the development of ground water classifications and associated standards which specify maximum contaminant levels for each classification	Potential ARARs due to the presence of contaminants in ground water
Surface Water -- RI Water Pollution Control Law (RIGL, Title 46, Chapter 12)	RI Water Quality Standards	Establishes water use classification and water quality criteria for all waters of the state. Also establishes acute and chronic water quality criteria for the protection of aquatic life.	Potential ARARs due to the potential presence of contaminants in surface water.
Soils -- RIDEM	Soil Cleanup Levels (Guidance)	Establishes soil cleanup levels for PCBs.	Potential ARAR due to presence of PCBs in soils.
Air -- RI Cl an Air Act (RIGL Title 23, Chapter 23)	Air Pollution Control Regulation Standards	Establishes maximum ambient levels for criteria pollutants.	Potential ARARs for alternatives involving treatment actions which emit criteria pollutants.

TABLE 3
PRELIMINARY IDENTIFICATION OF FEDERAL LOCATION-SPECIFIC ARARs AND TBCs
NETC - NEWPORT

FEDERAL STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Wetlands -- Executive Order 11990	Protection of Wetlands	Regulates activities conducted in a wetland area to minimize the destruction, loss or degradation of the wetlands.	Potential ARARs due to presence of wetlands adjacent to sites.
Wetlands Construction and Management Procedures (40 CFR 6, Appendix A)	Protection of Wetlands	Sets forth EPA policy for carrying out the provisions of Executive Order 11900 (see above).	Potential ARARs due to presence of wetlands adjacent to sites.
Clean Water Act, Section 404 (40 CFR 230; 33 CFR 320-330)	Prohibition of Wetland Filling	Prohibits the discharge of dredged or fill material to a wetland without a permit issued by the Corp of Engineers.	Potential ARARs due to presence of wetlands adjacent to sites.
Coastal Areas-- Coastal Zone Management Act of 1972 (16 U.S.C. Sect. 1451)	Protection of Coastal Areas	Regulates land use along coastal areas of the U.S.	Potential ARARs as two sites are located along Narragansett Bay.
Navigable Waterways-- Rivers and Harbors Act of 1889 Section 10 (33 USC Sect. 4033, 404)	Protection of Harbors and Rivers	Regulates the obstruction/alteration of navigable waterways of the U.S. or harbor filling except upon approval of the USACE.	Potential ARARs due to location of Site 9 along Allen Harbor.
Floodplains -- Executive Order 11988	Protection of Floodplains	Regulates activities conducted in a floodplain to minimize adverse affects to the floodplain and ensure that consideration has been taken of flood hazards.	Potential ARARs as sites are located within the 100-year floodplain zone.

TABLE 3 (continued)
PRELIMINARY IDENTIFICATION OF FEDERAL LOCATION–SPECIFIC ARARs AND TBCs
NETC – NEWPORT

FEDERAL STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Flood Disaster Protection Act of 1973	Disaster Prevention	Regulates development in flood prone areas under FEMA.	Potential ARAR as sites are located within the 100–year floodplain zone. Applicable to remedial alternatives conducted within floodplain zones.
National Flood Insurance Act of 1968 (24 CFR 1909 .1–.24)		Provides flood insurance for disaster relief and establishes flood control methods.	Potential ARAR as sites are located within the 100–year floodplain zone. Applicable to remedial alternatives conducted within floodplain zones.
Rivers–– Wild and Scenic Rivers Act (16 U.S.C. 1271)	Protection of Riverways	Regulates activities in vicinity of designated rivers.	Potential ARARs as site is located in clos proximity of Hunt's River.
Fish and Wildlife Coordination Act (16 U.S.C. 661)	Protection of Wildlife Habitats	Prevents the modification of a stream or river that affects fish or wildlife.	Potential ARARs as sites are located adjacent to streams.
Wildlife–– Endangered Species Act of 1973 (16 U.S.C. 1531)	Protection of Endangered Species	Restricts activities in areas inhabited by registered endangered species.	Potential ARAR as surrounding wetlands may sustain endangered or threatened wildlife species.
Historic Places–– National Historic Preservation Act of 1966 (16 USC 470, et seq.)	Protection of Historic Places	Requires actions to take into account effects on properties included in or eligible for the National Register of Historic Places and minimizes harm to National Historic Landmarks.	Potential ARAR for activities which could impact historic places.
Archeological and Historic Presevation Act of 1974 (132 CFR 229 & 229.4, 43 CFR 7 & 7.4)	Protection of Arch ological and Historic Lands	Restricts th use of land of known archeological or historical significance.	Potential ARAR for activities which could impact archeological or historic places.

TABLE 4
PRELIMINARY IDENTIFICATION OF STATE LOCATION–SPECIFIC ARARs AND TBCs
NETC – NEWPORT

STATE STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Wetlands – – RI Wetlands Law (RIGL Title 2, Chapter 1)	Regulation of Activities In and Around Wetlands	Provides for classification of coastal wetlands and freshwater wetlands and establishes permit requirements for activities which impact freshwater wetlands.	Potential ARARs if a remedial action is proposed within a wetland area (wetland areas exist adjacent to some of the NCBC sites).
Coastal Areas– – RI Coastal Resources Management Law (RIGL, Title 46, Chapter 23)	Protection of Coastal Areas	Regulates land use in or adjacent to coastal resources.	Potential ARARs as two of the sites are located along Narragansett Bay.

TABLE 5
PRELIMINARY IDENTIFICATION OF FEDERAL ACTION-SPECIFIC ARARs AND TBCs
NETC - NEWPORT

FEDERAL STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
CERCLA (Title I Section 101,111)	National Contingency Plan (40 CFR 300)	Establishes funding and provisions for the cleanup of hazardous waste sites.	ARARs as the NCBC site is included on the National Priorities List.
Superfund Amendments and Reauthorization Act (42 U.S.C. 9601)	Cleanup Standards/ Response Action	Treatments must provide permanent reductions in volume, toxicity and mobility of wastes and satisfy ARARs.	ARARs as the NCBC site is included on the National Priorities List.
Hazardous and Solid Waste Amendments of 1984 (HSWA)	Land Disposal Restrictions	Prohibits placement of hazardous wastes in locations of vulnerable hydrogeology and lists certain wastes, which will be evaluated for prohibition by EPA under RCRA.	Potential ARARs which may limit the use of land disposal in remediating certain hazardous wastes.
Resource Conservation and Recovery Act (40 CFR 264 and 265)	Requirements for Hazardous Waste Treatment Facility Design and Operating Standards for Treatment and Disposal Systems	Outlines specifications and standards for design, operation, closure and monitoring of performance for hazardous waste storage, treatment and disposal facilities.	Potential ARARs for alternatives which utilize a surface impoundment, waste pile, landfill, land treatment or incineration for on-site disposal/ treatment of wastes.
RCRA (40 CFR 264) Subpart F	Ground Water Protection	Ground water monitoring/corrective action requirements; dictates adherence to MCLs and establishes points of compliance.	Potential ARARs for alternatives which utilize a landfill for the ultimate disposal of hazardous waste materials and/or free liquids.
RCRA (40 CFR 264) Subpart G	Closure/Post Closure Requirements	Establishes requirements for the closure and long-term management of a hazardous disposal facility.	Potential ARARs for alternatives which utilize a landfill for the ultimate disposal of hazardous waste materials and/or free liquids.
RCRA (40 CFR 264) Subpart I	Use and Management of Containers	Outlines use and management standards applicable to owners and operators of all hazardous wast facilities that store containers of hazardous waste.	Potential ARARs for remedial actions which require storage of hazardous waste in containers.

TABLE 5 (continued)
PRELIMINARY IDENTIFICATION OF FEDERAL ACTION–SPECIFIC ARARs AND TBCs
NETC – NEWPORT

FEDERAL STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
RCRA (40 CFR 264) Subpart L	Waste Piles	Regulates owners and operators of facilities that store or treat hazardous waste in piles.	Potential ARARs for remedial alternatives which utilize a waste pile for on–site storage/treatment of waste.
RCRA (40 CFR 264) Subpart O	Incinerator Restrictions	Outlines specifications and standards for incinerating hazardous waste.	Potential ARARs for alternatives which utilize incineration for on–site treatment of wastes.
RCRA (40 CFR 262)	Generator Requirements for Manifesting Waste for Off–Site Disposal	Standards for manifesting, making and recording off–site waste shipments for treatment/disposal.	Potential ARARs for alternatives which utilize an off–site treatment/disposal method.
RCRA (40 CFR 263)	Transporter Requirements for Off–Site Disposal	Standards for transporters of hazardous waste materials.	Potential ARARs for alternatives which utilize an off–site treatment/disposal method.
RCRA (40 CFR 268)	Land Disposal Restrictions	Identifies hazardous wastes that are restricted from land disposal and sets treatment standards for restricted wastes.	Potential ARARs which may limit th use of land disposal in remediating certain hazardous wastes.
Toxic Substance Control Act (TSCA) (40 CFR 761, Subpart D)	Storage and Disposal Requirements for PCB–contaminated Materials	Establishes treatment and disposal requirements for PCB–contaminated materials.	Potential ARARs for alternatives which involve treatment or disposal of PCB–contaminated materials, including soils.
Safe Drinking Water Act (40 CFR 144 and 146)	Underground Injection Control Requirements	Establishes the general requirements, technical criteria and standards for underground injection wells.	Potential ARARs for alternatives which utilize underground injection as a remedial method.
Clean Water Act (40 CFR 122–125)	National Pollutant Discharge Elimination System (NPDES) Permit Requirements	Permits contain applicable effluent standards (i.e., technology–based and/or water quality–based), monitoring requirements, and standards and special conditions for discharge.	ARARs for alternatives involving treatment methods which discharg effluents to area water bodies.

TABLE 5 (continued)
PRELIMINARY IDENTIFICATION OF FEDERAL ACTION-SPECIFIC ARARs AND TBCs
NETC - NEWPORT

FEDERAL STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Clean Water Act (40 CFR 403)	Discharge to Publicly-Owned Treatment Works (POTW)	A national pretreatment program designed to protect municipal wastewater treatment plants and the environment from damage that may occur when hazardous, toxic or other non-domestic wastes are discharged into a sewer system.	ARARS for alternatives involving treatment actions which discharge effluents to POTWs.
Clean Water Act (40 CFR 404)	Requirements for Discharge of Dredged or Fill Material	Prohibits activities that impact a wetland unless no other practical alternatives are available.	ARARs for alternatives conducted in or around adjacent wetlands.
Fish & Wildlife Coordination Act (16 U.S.C. 661)	Protection of Wildlife Habitats	Regulates actions which cause the impoundment, diversion or modification of a body of water, or affects fish and wildlife.	ARARs for alternatives conducted around wetlands and adjacent streams.
Clean Air Act (40 CFR 50)	National Ambient Air Quality Standards (NAAQS)-Particulates	Establishes maximum concentrations for particulates and fugitive dust emissions.	ARARs for alternatives involving treatment methods which impact ambient air (i.e. incineration, soil venting, etc.).
Clean Air Act (40 CFR 50)	New Source Performance Standards (NSPS)	Requires Best Available Control Technology (BACT) for new sources, and sets emissions limitations.	ARARs for alternatives involving tr atment methods which impact ambient air (i.e., incineration, soil venting, etc.).
Clean Air Act (40 CFR 61)	Emissions Standards for Hazardous Pollutants (NESHAPS)	Establishes emissions limitations for hazardous air pollutants.	Potential ARARs for alternatives using treatments (i.e., incineration, etc.) which result in emissions to the air.
Hazardous Materials Transportation Act (49 CFR 170, 171)	Rules for Transportation of Hazardous Materials	Procedures for packaging, labelling, manifesting, and off-site transport of hazardous materials.	ARARs for alternatives involving the off-site shipment of hazardous materials or waste.
Occupational Safety and Health Act (29 CFR 1904)	Recordkeeping, Reporting and Related Regulations	Outlines recordkeeping and reporting requirements.	ARARs for all contractors/subcontractors involved in hazardous activities.

TABLE 5 (continued)
PRELIMINARY IDENTIFICATION OF FEDERAL ACTION–SPECIFIC ARARs AND TBCs
NETC – NEWPORT

FEDERAL STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
Occupational Safety and Health Act (29 CFR 1910)	General Industry Standards	Establishes requirement for 40–hour training and medical surveillance of hazardous waste workers. Establishes Permissible Exposure Limits (PELs) for workers at hazardous waste operations and during emergency response.	ARARs for workers and the workplace throughout the implementation of hazardous activities.
Occupational Safety and Health Act (29 CFR 1926)	Safety and Health Standards	Regulations specify the type of safety equipment and procedures for site remediation/excavation.	ARARs for workers and the workplace throughout the implementation of hazardous activities.

TABLE 6
PRELIMINARY IDENTIFICATION OF STATE ACTION-SPECIFIC ARARs AND TBCs
NETC - NEWPORT

STATE STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
RI Water Pollution Control Act (RIGL, Title 46, Chapter 12)	RI Water Quality Regulations	Requirements for discharging to area waters.	Potential ARARs for alternatives which involve the discharge of treated water to surface water or ground water.
	RI Pollutant Discharge Elimination Systems	Permits and regulates discharge to area surface waters.	Potential ARARs for alternatives which involve the discharge of treated water to surface water.
	RI Pretreatment Regulations	Rules concerning pretreatment of water prior to discharge to a POTW.	Potential ARARs for alternatives involving the use of Publicly Owned Treatment Works (POTW).
	RI Underground Injection Control Regulations	Rules concerning the reinjection of treated ground water.	Potential ARARs for alternatives involving the reinjection of treated ground water.
Public Drinking Water Laws (RIGL, Title 46, Chapter 14)	Protection of Public Drinking Water	Establishes rules concerning discharge to any source of water supply for drinking purposes.	Potential ARARs for alternatives which affect public public drinking water supplies.
RI Ground water Protection Act (RIGL, Titl 46, Chapter 13.1)	Protection of Ground Water	Establishes ground water classifications and maximum contaminant levels for each classification.	Potential ARARs for alternatives involving the treatment of contaminated ground water. Will establish cleanup levels.
RI Hazardous Waste Management Act of 1978 (RIGL, Title 23, Chapter 19.1)	Hazardous Waste Management	Rules and regulations for hazardous waste generation, transportation, treatment, storage, and disposal.	ARARs for alternatives involving the hazardous waste management or on-site or off-site disposal activities.
RI Refuse Disposal Law	Solid Waste Management	Rules and regulations for solid waste management facilities.	ARARs for alternatives involving the on-site storage and disposal of solid wastes.
RI Underground Storage Tanks Act (RIGL, Title 46, Chapter 12.1)	Regulations for Underground Storage Facilities used for Petroleum Products and Hazardous Materials	Permits and regulates installation, operation and closure of underground storage tanks.	ARARs for alternatives involving closure of existing underground storage tanks.

TABLE 6 (continued)
PRELIMINARY IDENTIFICATION OF STATE ACTION–SPECIFIC ARARs AND TBCs
NETC – NEWPORT

STATE STATUTE	REGULATION/GUIDANCE	SYNOPSIS	APPLICABILITY TO SITE CONDITIONS
RI Clean Air Act (RIGL, Title 23, Chapter 23)	General Air Quality and Air Emissions Requirements	Sets emmissions limitations for particulates and visible air contaminants.	ARARs for alternatives involving remedial actions which impact ambient air.
RI Hazardous Substance Community Right to Know Act (RIGL, Title 23, Chapter 24.4)	Public Right–to–Know Requirements	Establishes rules for the public's right–to–know concerning hazardous waste storage and transportation.	ARARs for alternatives involving handling of hazardous waste materials, and transportation off–site.

TABLE 7

GENERAL RESPONSE ACTIONS FOR NETC-NEWPORT SITES

Operable Unit	*General Response Actions*
Soil	• No Action • Institutional Control • Containment • Source Removal • Off-site Disposal • On-site Disposal • Off-site Treatment • On-site Treatment • In Situ Treatment
Ground Water	• No Action • Institutional Control • Containment • Off-site Treatment • On-site Treatment • In Situ Treatment • Extraction/Discharge
Surface Water	• No Action • Institutional Control • Collection • Diversion • Off-site Treatment • On-site Treatment
Sediment	• No Action • Institutional Control • Containment • Source Removal • Off-site Disposal • On-site Disposal • Off-site Treatment • On-site Treatment • In Situ Treatment

TABLE 8

PRELIMINARY ACTION ALTERNATIVES SOIL/SEDIMENT

RESPONSE ACTION	*REMEDIAL ALTERNATIVE*	*DATA REQUIREMENTS*
NO ACTION	Fence/Warning Signs	Risk Assessment
INSTITUTIONAL CONTROL	Deed Restrictions	Risk Assessment
CONTAINMENT	Capping	Risk assessment
	Vertical Barrier	Hydrogeologic data
SOIL DISPOSAL	On-site	Regulatory requirements
	Off-site	Regulatory requirements, Disposal facility availability
SOILS TREATMENT*	On-site Treatment	Treatability studies/pilot testing
	Volatiles -	
	Thermal Treatment	Ash content, moisture content
	Plasma Arc Pyrolysis	Moisture content
	Semivolatiles -	
	Dechlorination	Particle size distribution
	Soil Washing	Particle size distribution
	Incineration	Ash content, moisture content
	Inorganics -	
	Soil Stabilization	Moisture content
	Soil Washing	Particle size distribution
	Thermal Immobilization	Moisture content
	In Situ Treatment -	
	Biodegradation (organics)	BOD/COD, TOC, pH
	Stabilization	Moisture content
	Soil Venting (organics)	Particle size distribution
	Vitrification	Contaminant depth, geology
	Off-site Treatment	
	Incineration	Incinerator availability
	Various others	

* A risk assessment may also be a data requirement for establishing levels of treatment.

TABLE 9

PRELIMINARY ACTION ALTERNATIVES GROUND/SURFACE WATER

RESPONSE ACTION	REMEDIAL ALTERNATIVE	DATA REQUIREMENTS
NO ACTION	Fence/Warning Signs	Risk assessment
	Continued Monitoring	Risk assessment
INSTITUTIONAL CONTROL	Ground Water Use Restrictions	Risk assessment
CONTAINMENT	Capping	Risk assessment
	Vertical Barrier	Hydrogeologic data
EXTRACTION/ COLLECTION	Extraction Wells	Hydrogeologic data
	Well Points	Hydrogeologic data
	French Drains	Hydrogeologic data
	Diversion Structures	Hydrologic data
OFF-SITE TREATMENT*	POTW	Administrative/technical requirements
	RCRA Facility	Location/capacity/unit processes
ON-SITE TREATMENT*		Treatability studies/pilot testing
	Organics -	
	Bioreactor	BOD/COD
	PACT™	BOD/COD
	Air Stripping	Henry's Law constants
	Steam Stripping	Henry's Law constants
	Carbon Adsorption	Adsorption isotherms
	Resin Adsorption	Suspended solids
	UV Oxidation	pH, temperature, TDS
	Inorganics -	
	Reverse Osmosis	pH, suspended solids
	Ion Exchange	Suspended solids
	Precipitation	TDS, suspended solids
	Membrane Microfiltration	Suspended solids
	Electrochemical	pH
IN SITU TREATMENT*	Biodegradation	BOD/COD, pH
DISCHARGE	Injection Wells	Hydrogeologic data
	Infiltration Galleries	Hydrogeologic data
	Surface Water	Regulatory requirements
	Storm Sewer	Location
	Sanitary Sewer	Location

* A risk assessment may also be a data requirement for establishing levels of treatment.

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

VOLUME VIII
TREATABILITY STUDY AND FEASIBILITY STUDY PLAN

PHASE II RI/FS WORK PLAN

SITE 02 - MELVILLE NORTH LANDFILL

NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, Connecticut

Prepared For:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

September 1992

TRC-EC Project No. 6760-N81-110
Contract No. N62472-86-C-1282

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1.0 INTRODUCTION

This document describes the tasks associated with conducting treatability studies, pilot testing, and Feasibility Studies (FS) at the Melville North Landfill site. A plan for conducting treatability studies is presented initially. A discussion of the FS process follows.

2.0 TREATABILITY STUDY/PILOT TESTING PLAN

While treatability study/pilot testing may be appropriate for some of the NETC-Newport sites, initiation of the Feasibility Study process, specifically the initial development and screening of remedial alternatives, allows for a more focused application of such testing. Currently, no sites are considered to be adequately characterized to allow for the identification of applicable treatability studies. Additional environmental sampling will provide added information on ambient or background conditions or the extent of contamination. This additional information, along with the preliminary scoping of remedial alternatives within the Feasibility Study process, will allow for a better definition of applicable technologies. Since treatability studies for certain technologies can be costly, it is essential to limit the number of technologies being considered prior to the initiation of such studies. As part of this task, TRC-EC project team members will meet with Navy/NETC-Newport representatives including Technical Review Committee Members to discuss the need for and suggested scope of the treatability studies. The meeting will be scheduled once the preliminary Phase II analytical results are available and preliminary remedial alternative scoping activities have been conducted.

This section will discuss in a preliminary nature those sites which may require treatability study/pilot testing in the future, and potential remedial technologies which may require treatability study/pilot testing to demonstrate their applicability at a given site. A review of Phase I RI analytical data and the results of the Phase I Risk Assessment with respect to chemical-specific, enforceable ARARs (e.g., MCLs) and acceptable risk levels (e.g., 1×10^{-6} for carcinogenic risks and a hazard index of less than 1 for noncarcinogenic risks) provides a preliminary indication of the types of contaminants which may require treatment at the Melville North Landfill site.

For soil contaminants, no enforceable chemical-specific ARARs have been identified. Therefore, for this preliminary evaluation, the results of the Phase I Risk Assessment are used to identify potential site contaminants requiring remediation. The soil contaminants which were detected at the site at levels associated with risk estimates which contributed most to carcinogenic risk levels include arsenic and PAHs. Antimony and copper were both detected at levels in site soils which contributed the most to noncarcinogenic risks.

For ground water, the MCLs for aluminum, beryllium, cadmium, iron, manganese, and lead were the most commonly exceeded MCLs at the site. The following analytes/compounds were also detected at levels exceeding MCLs, although less frequently: chromium, nickel, xylene, benzene, ethylbenzene, PCBs, and 1,4-dichlorobenzene. At the Melville North Landfill site, estimated risks exceeded the acceptable risk levels associated with ground water exposure/ingestion for arsenic. Analytes which were detected more infrequently in the ground water at levels which result in carcinogenic or noncarcinogenic risks include beryllium, chromium, copper, mercury, thallium, vanadium, zinc, PAHs, 1,1-dichloroethene, trichloroethene, and vinyl chloride.

Based on this preliminary analysis, remedial technologies which offer inorganic treatment of soils and/or ground water appear to be the most applicable to the Melville North Landfill site. Treatability studies could be performed for technologies which are innovative and relatively unproven or for technologies which have a proven record but which require testing to ensure remedial action objectives can be achieved. Examples of soil treatment technologies which could be applicable to inorganic contaminants and which may require treatability study testing include such technologies as soil stabilization, soil washing, or in-situ vitrification. Examples of ground water treatment technologies which could be applicable to inorganic contaminents and which require treatability study testing include steam stripping, membrane microfiltration, and powdered activated carbon treatment (PACT™).

3.0 FEASIBILITY STUDY PLAN

The Feasibility Study (FS) will draw upon existing site characterization data, existing remedial treatment process data, existing treatability study data, where available, and baseline risk assessment findings to evaluate potential remedial options appropriate to the specific site. The methodology to be followed in conducting the FS will conform with the requirements of CERCLA, SARA, and the National Contingency Plan (NCP). The U.S. Environmental Protection Agency (EPA) interim final guidance document entitled, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, dated October 1988, provides a basis for conducting Feasibility Studies in accordance with these requirements. The Feasibility Study plan presented below is based upon this guidance.

To date, the Confirmation Study and the Phase I Remedial Investigation (RI) activities have been conducted, providing an understanding of existing site conditions. The Phase II RI will attempt to eliminate present data gaps and provide a more comprehensive understanding of the site under the Feasibility Study process. The Feasibility Study will be based on the findings of the site investigations. It will include a systematic evaluation and screening of possible remedial technologies, allowing the definition and development of a focused range of comprehensive remedial alternatives, which will provide the basis for the selection of a recommended remedial alternative. The overall approach for conducting Feasibility Studies is shown in Figure 1. A planned outline for the Feasibility Study report is presented in Table 1. Major components of an FS are described below.

3.1 Identification and Screening of Technologies

Candidate remedial alternatives will be developed through an identification and screening process. This process consists of development of goals of remediation, identification of general categories of remedial actions (e.g., treatment, containment, etc.) to be considered, estimation of volumes or areas of media to which these general kinds of actions may be applied, identification of the technologies applicable to each of the general kinds of actions, and then the screening of these technologies on the basis of technical implementability. Each of these process steps is discussed in more detail below.

3.1.1 Remedial Action Objectives

For each medium or operable unit, remedial action objectives will be established for protection of human health and the environment. Remediation goals will be derived from identified Applicable or Relevant and Appropriate Requirements (ARARs) or from the baseline risk assessment and/or ecological assessment. In this way, remedial action objectives will be developed on the basis of an integrated analysis of contaminant concentrations, exposure routes, and receptor populations.

3.1.2 General Response Actions

Once remedial action objectives are defined, qualitative general response actions which are capable of meeting these objectives will be identified for each medium. General response actions are generic in nature and include such broad measures as treatment, containment, and extraction.

3.1.3 Estimation of Quantities of Media to be Remediated

The volumes and areas of media to which the general response actions are to be applied will be estimated. Estimates will be based upon the data defining the nature and extent of site contamination, as well as the site geology and hydrogeology.

3.1.4 Identification and Screening of Remedial Technologies

The universe of technology types and process options that are potentially applicable to the identified general response actions and corresponding estimated quantities of media to be remediated will be identified and evaluated.

The range of identified remedial technologies will be reduced by screening the technology types on the basis of technical implementability. The types of contaminants and existing site conditions will provide the basis on which to assess the technical implementability of technology types. For instance, the physical or chemical nature of the identified contaminants may preclude the use of certain remedial technologies.

3.1.5 Selection of Representative Technology Process Options

Upon completion of the technology screening, the process options associated with each remaining technology type will be evaluated with respect to effectiveness, implementability and cost. On the basis of this evaluation, a representative process option will be chosen for each technology type. This representative process option is then used in the development and evaluation of remedial alternatives.

3.2 Development and Screening of Alternatives

A range of remedial alternatives will be developed by combining representative process options in a manner which addresses remediation of the site as a whole. Upon development of a preliminary range of remedial alternatives, the alternatives are screened in order to reduce the number of alternatives which will undergo detailed analysis. This alternative development and screening process is discussed in further detail below.

3.2.1 Assembly of Remedial Alternatives

Representative process options will be used to develop a range of remedial alternatives that will address human health and environmental risks on a site-wide basis. It is expected that approximately eight to twelve preliminary remedial alternatives will be developed. As required under SARA, the range of alternatives will include the following categories:

- Alternatives relying primarily on treatment which will reduce the toxicity, mobility, or volume of the hazardous substances, pollutants, or contaminants, including an alternative which, through treatment, eliminates or minimizes the need for long-term management at the site;
- Alternatives that involve little or no treatment but provide protection of human health and the environment, primarily by preventing or controlling potential exposures to contaminants;
- For alternatives involving ground water response actions, alternatives that attain remedial goals within different restoration periods;
- One or more alternatives which involve the use of innovative technologies; and
- The no-action alternative.

A general definition of the remedial alternatives is developed at this point to provide a basis for the preliminary alternative screening. A description of each alternative is provided which includes the following items, as appropriate:

- Locations of areas to be remediated;
- Approximate volumes of each media to be subject to remediation by each technology type;
- Sizing and general configuration of extraction and treatment systems or containment structures;
- Preliminary treatment process flow rates;
- Spatial requirements for treatment or containment systems;
- Transport distances for discharge or disposal technologies;
- Degree of attainment and general time frames for attainment of site-wide remedial action objectives; and
- Institutional restrictions and requirements such as permit requirements.

Definition of the alternatives also requires an evaluation of potential inter-media impacts, since at this point media-specific technologies are combined into alternatives which address multiple exposure pathways.

3.2.2 Alternative Evaluation and Screening

Once the range of alternatives has been developed, the individual alternatives will be evaluated on the basis of effectiveness, implementability, and cost, as discussed below.

Effectiveness Evaluation

Each alternative will be evaluated on the basis of the degree of human health and environmental protection it offers and the reductions in toxicity, mobility, or volume it is expected to provide both in the short-term and the long-term. Short-term effectiveness relates to the construction and implementation periods while long-term effectiveness pertains to the period following implementation.

Implementability Evaluation

The criterion of implementability serves as a measure of the feasibility of constructing, operating, and maintaining an alternative and is dependent on the technical feasibility and administrative feasibility of the alternative. Technical feasibility relates to the ability to construct, operate, maintain, and monitor the performance of the remedial components. Administrative feasibility relates to the ability to obtain the requisite permits and/or approvals from agencies of the government with jurisdiction over the activities involved and the ability to obtain the equipment and technical services needed to implement the technologies involved.

Cost Evaluation

Preliminary cost estimates will be developed for each alternative by discounting projected capital and O&M costs to a common base year. Estimates of projected costs will be based on cost curves, generic unit costs, vendor information, conventional cost estimating guides, prior estimates for similar configurations of remedial technology, and engineering judgement. Emphasis will be given to establishing relative costs of comparative accuracy due to the relatively unrefined nature of the alternatives at this point in the FS process.

Alternative Screening

Those alternatives that receive the most favorable composite evaluation on the basis of the three factors described above will be retained for detailed analysis. Where practicable, the retained alternatives will also preserve the range of treatment and containment technologies originally developed. Innovative technologies will be carried through the screening process if there is a reasonable belief that the innovative technology offers significant advantages over conventional technologies. It is expected that the total number of alternatives to be carried through the screening process will be in the range of five to eight.

3.3 Detailed Analysis of Alternatives

The alternatives that have been carried through the screening process will undergo detailed analysis in order to support the remedy selection process in accordance with CERCLA requirements. The results of these analyses will be summarized in an array format to facilitate comparisons among the alternatives. Final selection of a remedial alternative will be made subsequent to the preparation of the Feasibility Study and will be documented in the Record of Decision (ROD).

3.3.1 Evaluation Criteria for Detailed Analysis

Detailed analysis of alternatives in the feasibility study will be based upon evaluation of the following seven criteria:

1) Overall protection of human health and the environment;
2) Compliance with ARARs;
3) Long-term effectiveness and permanence;
4) Reduction of toxicity, mobility, or volume;
5) Short-term effectiveness;
6) Implementability; and
7) Cost.

Two additional criteria, state acceptance and community acceptance, will also be taken into consideration following completion of the Feasibility Study and associated public comment period, and will be addressed in the ROD.

3.3.2 Further Definition of Alternatives

Alternatives will be further defined as necessary to enable the evaluation criteria to be applied consistently and to enable cost estimates to be developed within the desired accuracy range of +50 percent to -30 percent.

3.3.3 Individual Detailed Analysis of Alternatives

Each alternative will undergo detailed evaluation relative to the seven criteria listed above. For each evaluation criterion, the general scope of the evaluation is described below.

Overall Protection of Human Health and the Environment

This criterion provides an overview of whether the alternative is protective of human health and the environment. It is based on other evaluation criteria, including long-term effectiveness and permanence, short-term effectiveness and compliance with ARARs. The way in which an alternative addresses the previously identified site risks through the use of treatment, engineering, or institutional controls is evaluated. In addition, consideration is given to any short-term risks and/or cross media impacts that may be associated with the implementation of an alternative.

Compliance with ARARs

This evaluation criterion addresses the manner in which the alternative complies with contaminant-specific, location-specific, and action-specific ARARs. The ARARs that apply to each alternative will be identified, and the manner in which the alternative meets the requirements of the ARAR will be described. When an ARAR will not be met, justification for a waiver that satisfies the requirements of CERCLA will be presented.

Long-Term Effectiveness and Permanence

This criterion addresses the degree of long-term risk that will be posed by treatment residuals, contaminated media, and/or untreated wastes remaining at the site after remedial response objectives have been met and the effectiveness and reliability of controls, if any, used to manage these risks.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This element of the detailed analysis focuses on the extent to which the alternative employs treatment technologies that permanently or significantly reduce toxicity, mobility, or volume of contaminated media as a principal element. The degree of treatment provided by the alternative, the irreversibility of the treatment, and the type and quantity of residuals remaining after treatment are discussed.

Short-Term Effectiveness

Short-term effectiveness relates to the human health and/or environmental impacts which result during the construction and implementation phases of the remediation, and the degree to which such impacts are controlled. This evaluation will encompass short-term impacts on the surrounding community, occupational impacts on workers engaged in construction and/or implementation activities, and short-term impacts on the environment. The time period required to meet remedial action objectives will also be estimated.

Implementability

This criterion considers the technical and administrative feasibility of implementing the alternative. As in the preliminary alternative screening, the technical feasibility of construction and operation, the administrative feasibility of obtaining permits and coordination with regulatory agencies, and the availability of the remedial services, materials, and personnel experienced in providing the services will be considered.

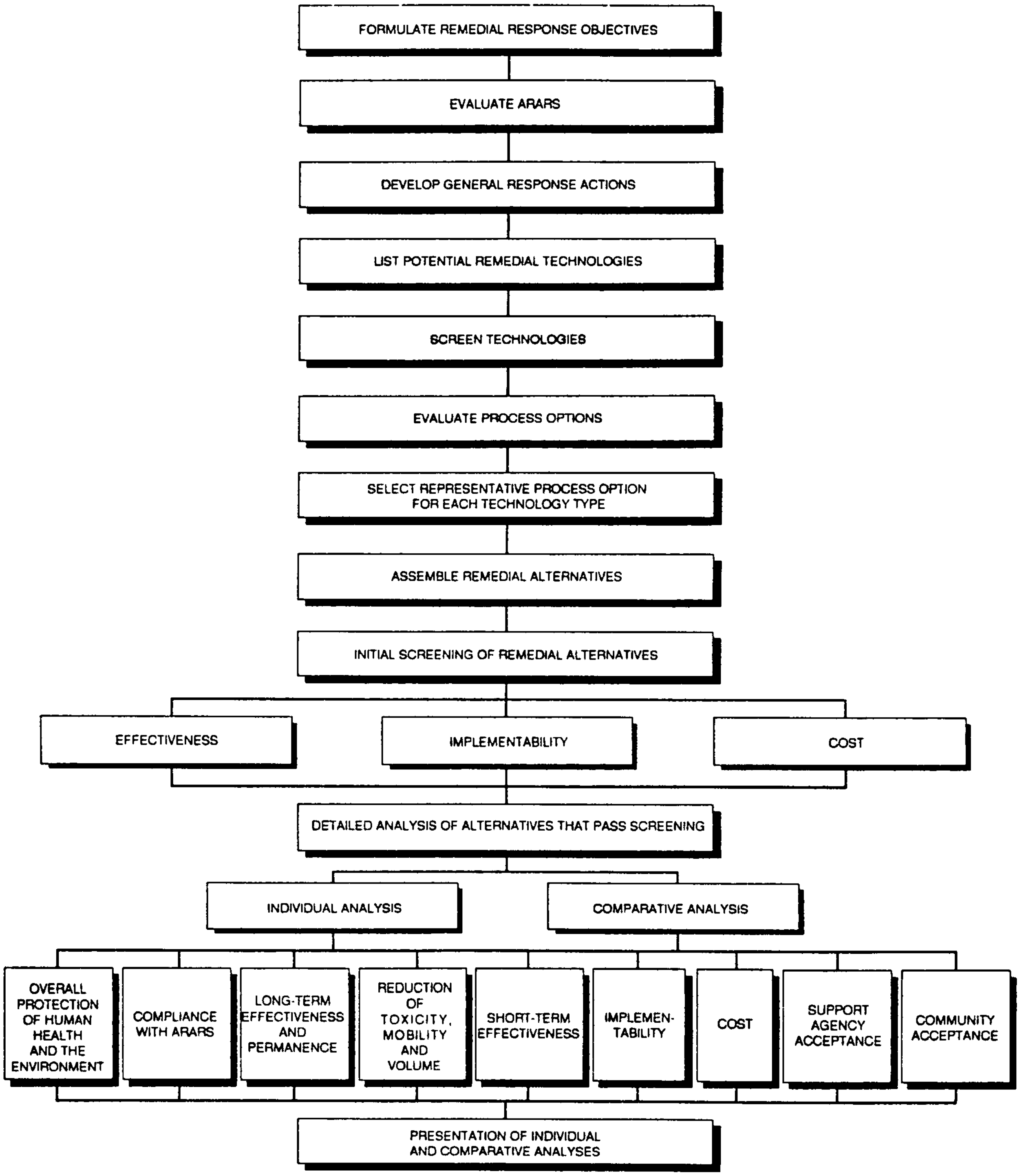
Cost

Cost estimates will be developed in conformance with the procedures contained in the U.S. EPA guidance document entitled, Remedial Action Costing Procedures Manual, dated September 1985. Estimates of the magnitude and timing of direct capital, indirect capital, and O&M costs will be made and future costs will be discounted to the present in order to calculate a present worth cost estimate for each alternative. The detailed and comprehensive information base available from the RI are expected to enable the formulation of cost estimates that fall within a range of accuracy of +50 percent to -30 percent. Factors which may limit the accuracy of the cost estimates, such as conflicting field data or uncertainties in the time required to reach remedial objectives, will be identified. A cost sensitivity analysis will be performed in which the impact of variations in design assumptions will be evaluated. Where there is sufficient uncertainty associated with the basic assumptions used to develop an individual cost, the assumptions will be varied and the overall impact on the total estimated cost will be calculated.

3.3.4 Comparative Analysis of Alternatives

Upon completion of the individual analyses of alternatives, a comparative analysis of alternatives will be conducted. Thus the relative performance of each alternative in relation to each of the seven evaluation criteria will be assessed. In this way the major tradeoffs to be weighed in the alternative selection process will be identified.

FIGURES



SOURCE USEPA

TRC Environmental Corporation

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NAVAL EDUCATION AND TRAINING CENTER — *NEWPORT RHODE ISLAND*

FIGURE 1.

FEASIBILITY STUDY APPROACH

Date 9/92 | Drawing No. 6760-N81

TABLES

TABLE 1

PLANNED FS REPORT FORMAT
NETC-NEWPORT

TABLE 1

(continued)

PLANNED FS REPORT FORMAT
NETC-NEWPORT

4.3 Comparative Analysis of Alternatives
   4.3.1 Short-Term Effectiveness
   4.3.2 Long-Term Effectiveness
   4.3.3 Implementability
   4.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment
   4.3.5 Compliance with ARARs
   4.3.6 Overall Protection of Human Health and the Environment
   4.3.7 Cost

5.0 References

Appendices

A Detailed Cost Estimates
B Risk Assessment Methods